

# Delaware River Basin Commission

## **Water Resources Program**

FY 2017-2019

March 15, 2017

## DRBC Water Resources Program FY 2017 - 2019

### Authorization

The Delaware River Basin Compact states:

*The commission shall annually adopt a water resources program, based upon the comprehensive plan, consisting of the projects and facilities which the commission proposes to be undertaken by the commission and other authorized governmental and private agencies, organizations and persons during the ensuing six years or such other reasonably foreseeable period as the commission may determine. (§ 3.2 DRB Compact, 1961)*

According to the Compact, "Project" shall mean any work, service or activity which is separately planned, financed, or identified by the commission, or any separate facility undertaken or to be undertaken within a specified area, for the conservation, utilization, control, development or management of water resources which can be established and utilized independently or as an addition to an existing facility, and can be considered as a separate entity for purposes of evaluation (§1.2.(g)).

### Scope and Organization

The Water Resources Program (WRP) covers fiscal years (FY) 2017 through 2019 (July 1, 2016 through June 30, 2019) and is an element of strategic planning for DRBC program direction over the next three years. The architecture is based on the requirements of the Delaware River Basin Compact (Compact) and the goals of the Key Result Areas of the *Water Resources Plan for the Delaware River Basin* (Basin Plan 2004).

The Program is presented in two parts:

**Section I: Conditions** summarizes water resource conditions in the Basin, including hydrologic conditions, water use and sufficiency, overall assessment of water quality, landscape conditions, and emerging issues that could affect long-range water resource planning and management in the Basin.

**Section II: Work Program** notes the key issues that focus the Commission's programs and summarizes by Key Result Area the initiatives the Commission plans to undertake over the next three years.

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## I. GENERAL STATEMENT OF CONDITIONS IN THE BASIN

### A. HYDROLOGIC CONDITIONS 2015-2016

#### Rainfall.

Compared to the rest of the continental US, the northeastern region experienced below-average precipitation during the 365-day period ending June 2016.<sup>1</sup> In the Delaware River Basin (DRB), precipitation averaged 5.41", or 11.5-percent below normal for the same period.<sup>2</sup>

Note: Annual reports on basin hydrologic conditions are available at:  
<http://www.nj.gov/drbc/hydrological/reports/annual-hydro-reports.html>

#### Reservoir Conditions and Management.

Combined storage in the three Upper Basin NYC reservoirs was above the long-term median at the start of the 365-day period ending June 30, 2016 (Figure 1). Storage decreased over the summer but remained above the long-term median during the summer and early autumn months of 2015. Storage dropped below the median in October and remained below at the start of 2016. Above-normal precipitation during February 2016 increased storage above the median briefly, but by early spring storage was below the median. Storage remained below the median at the end of the 365-day period.

Although combined storage was below the long-term median for the majority of the reporting period, storage did not go below the reservoir drought watch level. Consequently, DRBC's basin-wide drought operating plan was not implemented. The USGS River Master directed releases from the Upper Basin Reservoirs July through October 2015 and during June 2016 to meet the Montague Flow Objective. A total of 42 billion gallons was released during this period.

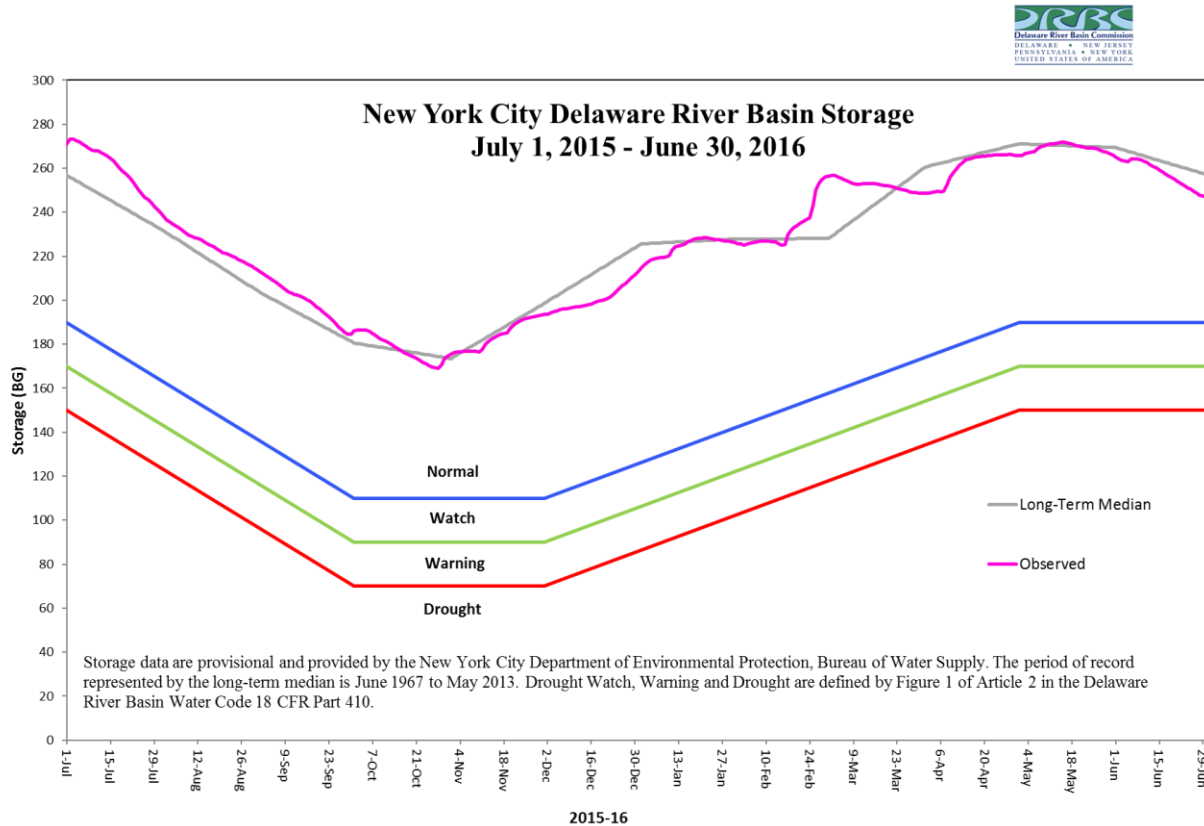
Both Beltzville Reservoir (located on the Pohopoco Creek, a tributary of the Lehigh River) and Blue Marsh Reservoir (located on the Tulpehocken Creek, a tributary of the Schuylkill River) maintained storage in the normal range during the 365-day period ending June 2016. DRBC did not direct releases during the period from Beltzville or Blue Marsh to meet the 3,000 cfs flow objective at Trenton.

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<sup>1</sup> NOAA. State of the Climate National Overview-Regional 12 Months Precipitation June 2016.  
[http://www.ncdc.noaa.gov/temp-and-precip/us-maps/12/201606?products\[\]=regionalpcpnrank#us-maps-select](http://www.ncdc.noaa.gov/temp-and-precip/us-maps/12/201606?products[]=regionalpcpnrank#us-maps-select)

<sup>2</sup> NWS Middle Atlantic River Forecast Center-monthly precipitation data reported by 38 of the 42 DRB counties. DRBC staff calculated cumulative 12-month precipitation departure from normal.

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**Figure 1. New York City's Delaware River Basin Storage, July 2015-June 2016.**

### **Groundwater Conditions.**

#### **New York (calendar year 2015)**

The groundwater levels in the Sullivan County well remained within the normal to slightly above-normal range throughout much of the year. Periodic decreases below the 25th percentile were observed during drier periods in February-March and the autumn season.

#### **Pennsylvania (calendar year 2015)**

Groundwater levels in five selected USGS county observation wells were used to represent Pennsylvania's groundwater conditions during 2015. The individual wells were selected according to their geographic locations in the Pennsylvania portion of the DRB: Wayne County WN 64 (northern), Schuylkill County SC 296 (western), Lehigh County LE 644 (central), Bucks County BK 1020 (eastern), and Chester County CH 10 (southern).

In the upper basin, water levels in the Wayne County and Schuylkill County observation wells decreased at the start of 2015. The Wayne County well was below the 25th percentile for most of the first half of the year before recovering to the normal to above-normal range during the remainder of the year. The Schuylkill County well water levels were variable, frequently below the 25th percentile during the drier first half of the year and again in the fall.

Water levels in the Lehigh County and Bucks County observation wells were within the normal range for most of the year. The Lehigh County well level was below the 25th percentile in response to dry conditions during February-March and again during November-December. The Bucks County well level decreased throughout the summer months, but briefly was below the normal range during October and December.

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Levels in the Chester County well were variable throughout the year. Water levels briefly were below the 25th percentile during late winter and spring, but then recovered. Levels showed a seasonal decline during the summer and dropped below normal again by late August.

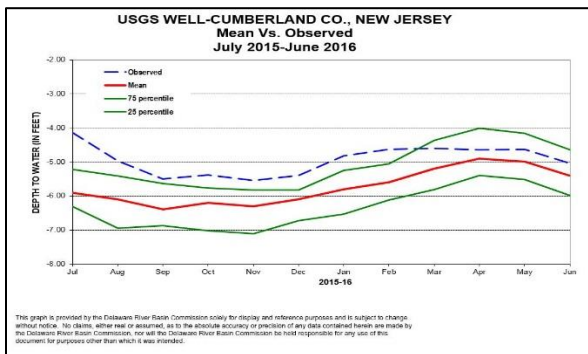
All five Pennsylvania observation wells ended the year within the normal range after the basin received above-normal precipitation during December.

### New Jersey (July 1, 2015 – June 30, 2015)

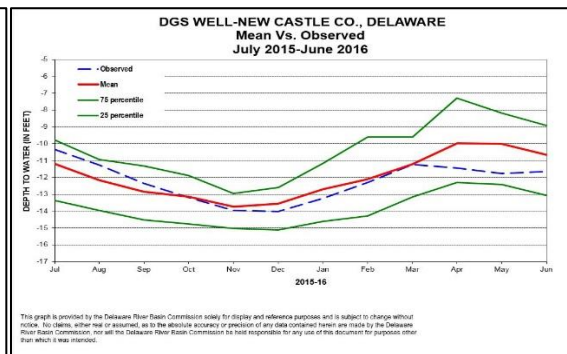
The well in Cumberland County NJ in the coastal plain recorded average monthly measurements above the normal range (greater than the 75-percentile) for the majority of the 365-day period ending June 30, 2016 (Figure 2). The well level was in the normal range in March 2016 where it remained at the end of the report period.

### Delaware (July 1, 2015 – June 30, 2015)

Average monthly measurements of groundwater within the New Castle County DE coastal plain well were within the normal range (25- to 75-percentile) throughout the 365-day period (Figure 3).



**Figure 2. NJ Groundwater. Mean (solid red line) vs. observed (dashed blue line) levels July 2015-June 2016 based on USGS well, Cumberland Co., NJ.**



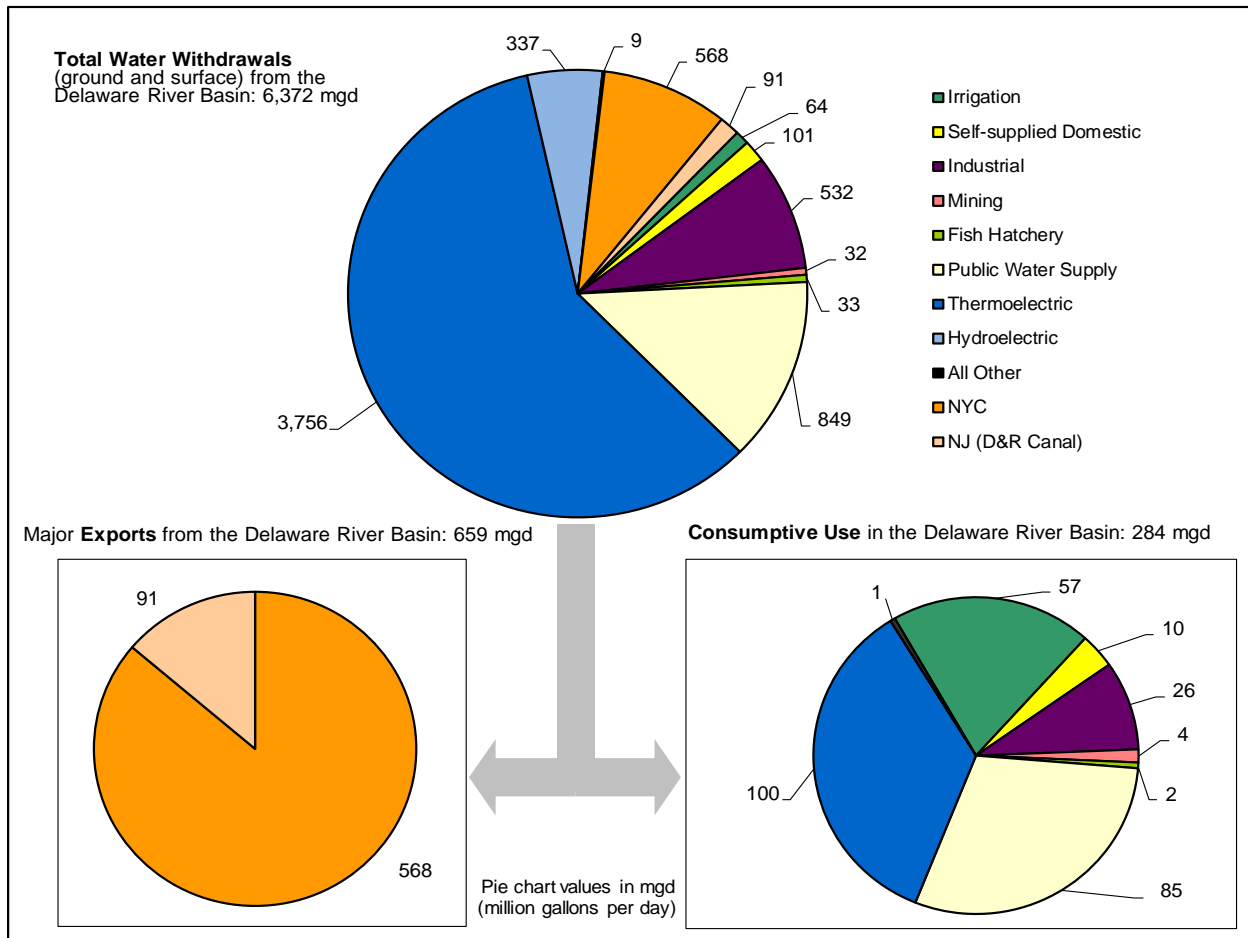
**Figure 3. DE Groundwater. Mean (solid red line) vs. observed (dashed blue line) levels July 2015-June 2016 based on DGS well, New Castle Co., DE.**

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### B. WATER USE AND SUFFICIENCY

#### Water Withdrawals and Trends

Understanding water withdrawals, water use, and supply is integral to the management of water resources. In recent years, our understanding of the ways in which water is withdrawn and used has improved greatly, as have the underlying systems in place to manage the data, meaning that more timely and comprehensive assessments can be made. Figure 5 shows the basin-wide picture of water withdrawals, exports, and consumptive use, by sector, based primarily on 2014 calendar year water use data; the data shown represent daily average withdrawals. Although the availability and completeness of water use data has improved significantly in recent years, due in part to the adoption of online reporting programs by basin state agencies, there are still some deficiencies that need to be addressed. For example, agricultural water use reporting (included within the "Irrigation" category in the Figure below) needs to improve in order to generate a more accurate assessment for this sector and improve our ability to plan for future needs.



**Figure 5. Withdrawals, Consumptive Use and Major Exports from the Basin 2014. (Note: for Self-supplied domestic estimates from other reporting years have been used as more recent data were not readily available.)**

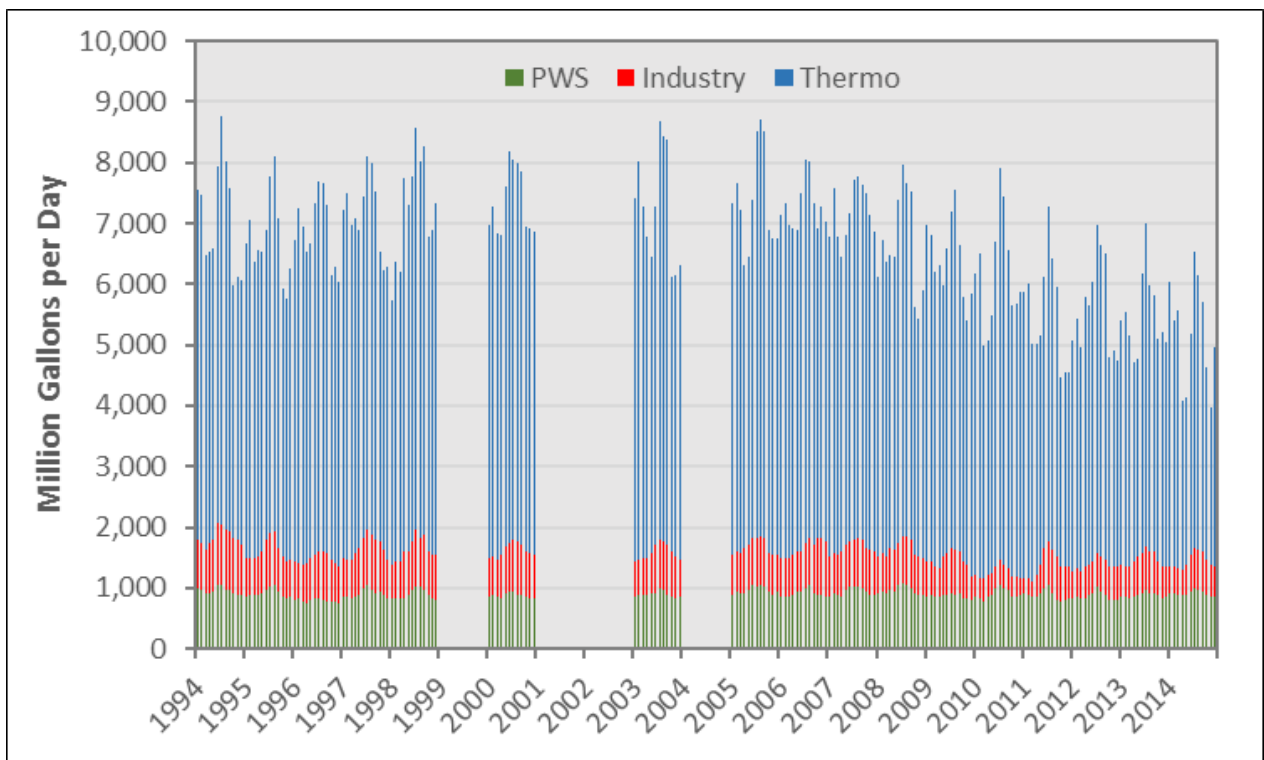
Key Delaware River Basin water use facts:

- Roughly 15 million people rely on water from the Basin for their daily water needs. Approximately 8.3 million people live in the Basin (2010 US Census), and the volume of exports to New York City and northeastern New Jersey is sufficient to supply water to an additional 7 million people;
- Total ground and surface water withdrawals from the Basin: 6,372 mgd (6.3 Billion gallons per day);
- Major Exports from the Basin: 659 mgd;

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- Consumptive Use in the Basin: 284 mgd;
- Over 90% of all water used in the Basin is obtained from surface waters; and
- Three dominant use sectors account for approximately 80% of total water withdrawals; these sectors are: power generation (Thermo, 59%), public water supply (PWS, 13%), and industrial use (Industry, 8%).

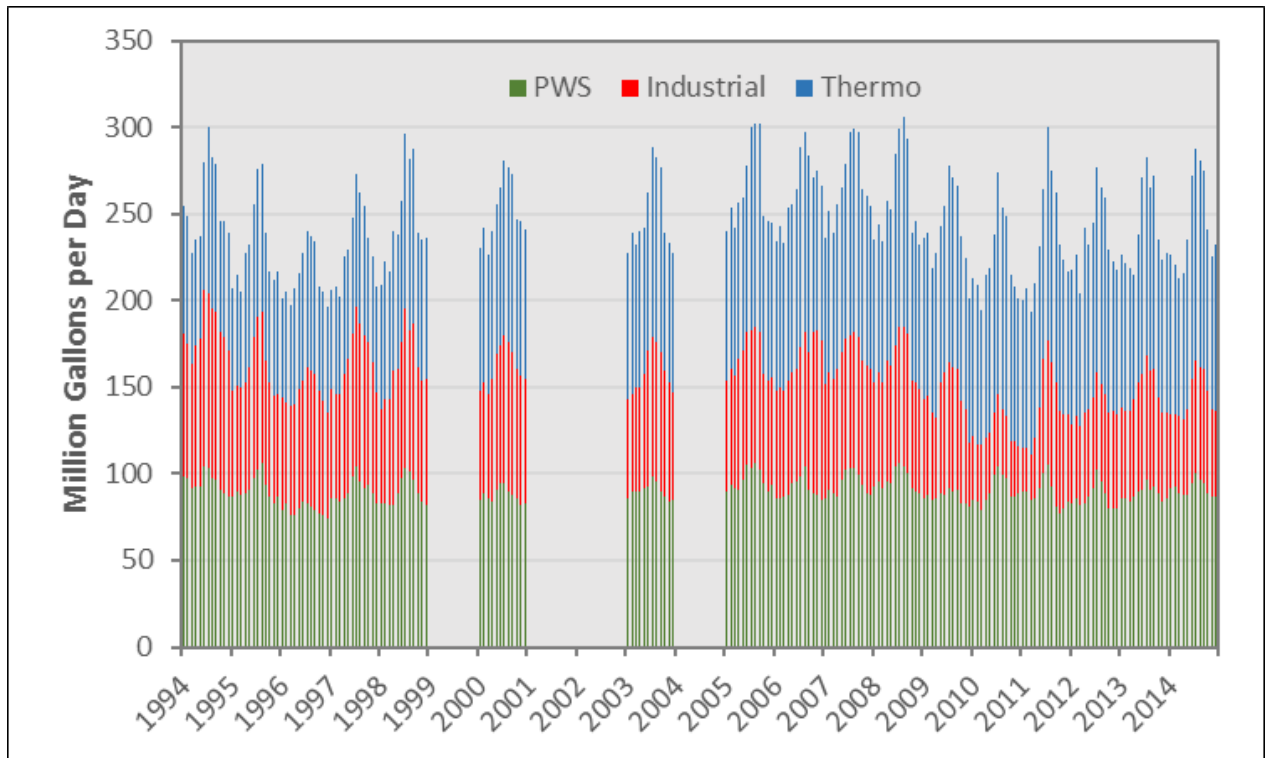
DRBC tracks withdrawals and water use in these three dominant water using sectors closely. Currently, data for these key sectors extend through calendar year 2014 and provide a monthly time series of data spanning a period of over 20 years. Although Figures 6 and 7 contain some data gaps, an overall pattern and trend in water withdrawals and consumptive use is apparent. The public water supply and industrial sectors display decreasing trends in total water withdrawn as well as consumptively used. Public water supply downward trends are primarily attributed to the influence of conservation practices, while industrial use downward trends are more likely the result of facilities exiting the industrial sector through closure or relocation outside the Basin. The thermoelectric sector displays an overall decreasing trend in total water withdrawals, but increases in consumptive use. This is attributed to the increasing use of cooling towers as opposed to once through cooling for new or upgraded facilities.



**Figure 6. Monthly Water Withdrawals for Three Key Sectors in the Delaware River Basin. (Note that no data are shown for months where data were incomplete to avoid visually skewing the trends).**



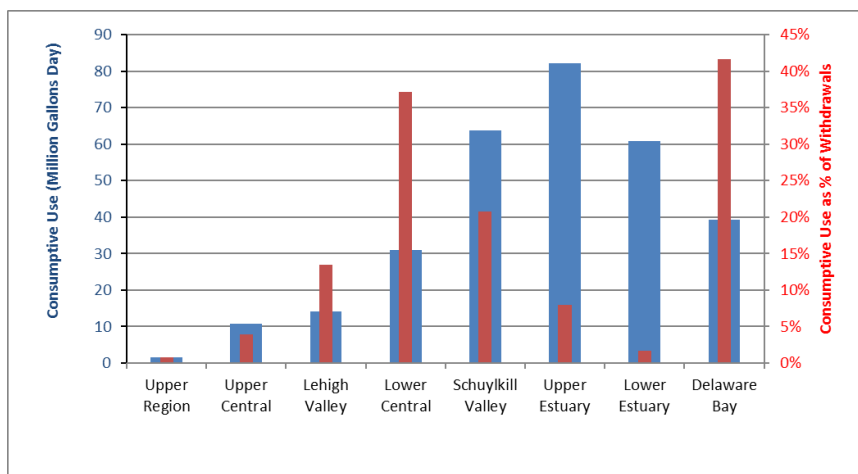
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**Figure 7. Monthly Consumptive Water Use for Three Key Sectors in the Delaware River Basin. (Note that no data are shown for months where data were incomplete to avoid visually skewing the trends).**

### Water Withdrawals and Consumptive Use

In managing water resources, the withdrawal volume may not be as important as where, when, and if water is returned to the system. Water not returned to the surface waters of the basin is considered consumptive use. Figure 8 illustrates both the range of withdrawals among the basin regions (see basin map in Figure 9) and consumptive use as a percentage of total withdrawals (excluding exports to NYC and NJ).



**Figure 8. Consumptive Use 2014 by Basin Region as total withdrawal (wide blue bar, see left axis) and as percentage of withdrawals (narrow red bar, see right axis).**

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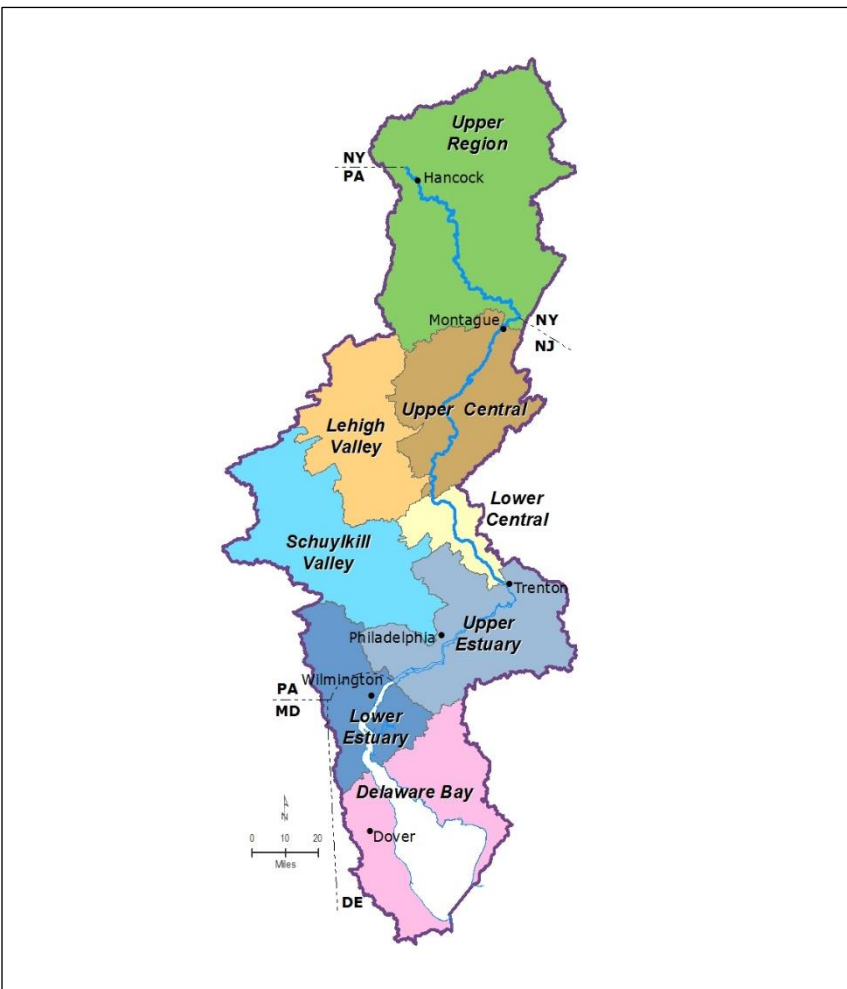


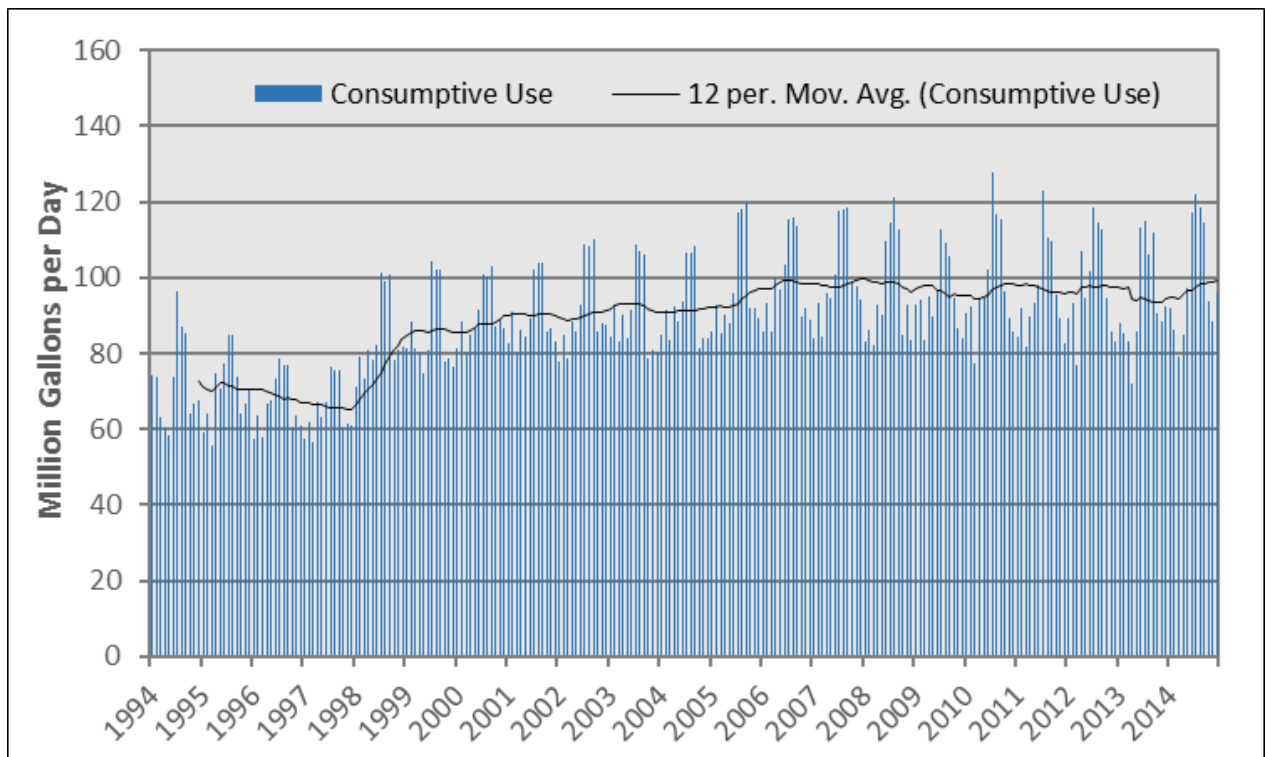
Figure 9. Map of Basin Regions

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### Cumulative Thermoelectric Withdrawals and Consumptive Use

Water withdrawals for thermoelectric power generation are primarily used for cooling purposes. The cooling process is typically achieved by either highly evaporative cooling towers or a once-through cooling process that uses a condenser to absorb heat. The two types of cooling use water in different ways. Evaporative cooling towers require a smaller volume of withdrawal but consume the majority of the water (typically >90% consumptive use). Once-through cooling requires much greater volumes of water at the intake, but the rate of loss to evaporation is very small (typically <1%). In terms of total consumptive use per energy unit (gallons per MWh), cooling towers have higher consumptive use factors. On average, cooling towers use 453 gal/MWh, while once-through systems use 307 gal/MWh. A decline in withdrawals for thermoelectric power generation over the past several years is evident in Figure 6 and is a result of plant closings, or decreased production, at facilities with once-through cooling systems.

However, the need for energy production in the basin continues to increase and other (smaller) facilities have come online to meet demand. The new facilities use evaporative cooling, which withdraws a lesser volume but evaporates a greater percentage of the withdrawal. Figure 10 shows the resulting increasing trend in consumptive water use, despite a decrease in overall water withdrawn for the thermoelectric power generating sector.



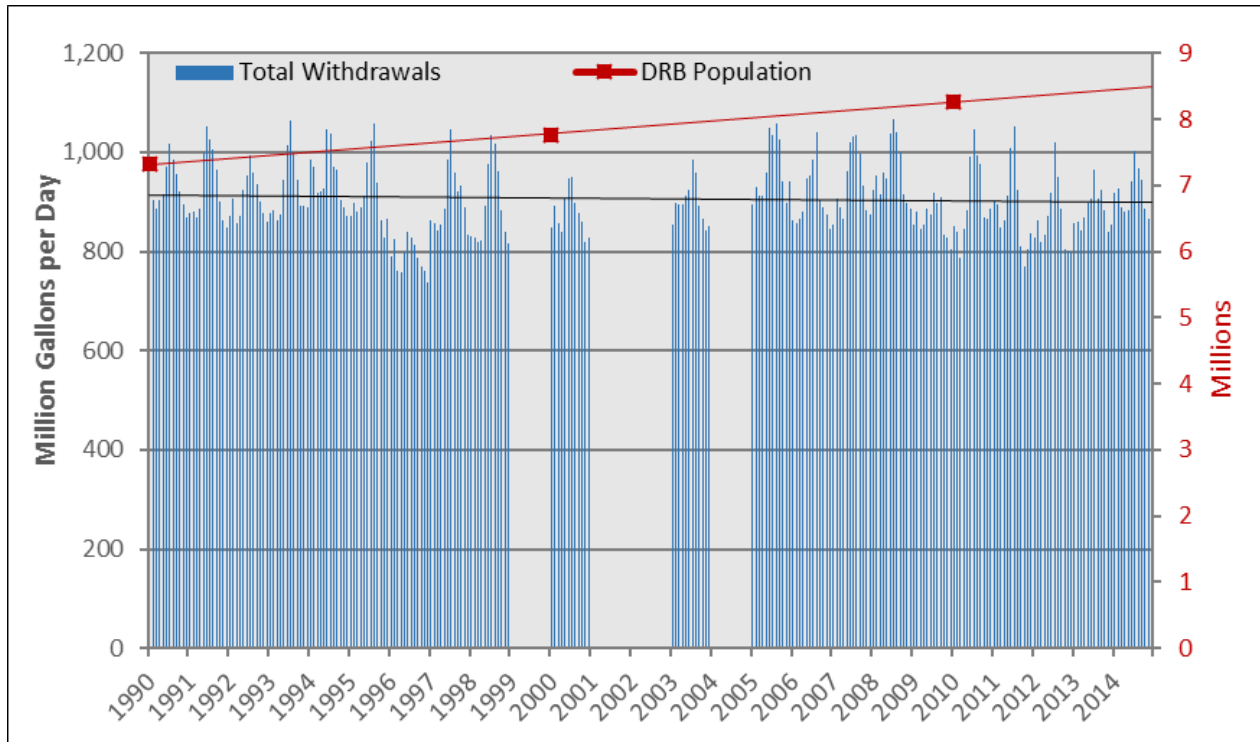
**Figure 10. Trend in Consumptive Use for Thermoelectric Power Generation in 1994-2014.**

Increases in demand for withdrawals for thermoelectric power generation are likely to occur over the next few decades. Any new capacity is likely to be cooled using evaporative methods (e.g., cooling towers) as required under USEPA regulations, potentially increasing consumptive water use.

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### Public Water Supply Withdrawals

Historic data for public water supply (PWS) withdrawals show a slight declining trend (see Figure 11) largely driven by water conservation measures in the form of changes in plumbing codes, enacted in the early 1990s, which required use of more efficient plumbing fixtures and fittings. In addition, education and awareness of water conservation practices have played a role in decreasing water use for this sector despite increases in population (shown by the red line in Figure 11). Although declining in the aggregate, withdrawals have increased in several systems where there are population growth regions (i.e., where water conservation practices cannot offset the more rapid increase in population). Over the past 30 years, DRBC has been a leader in enacting regulations to promote water conservation in the areas of source and service metering, leak detection and repair, plumbing fixtures and fittings, and water rate structures. The trend shown in Figure 11 indicates that these regulations have been successful and have contributed to a modest decline in PWS water withdrawals.

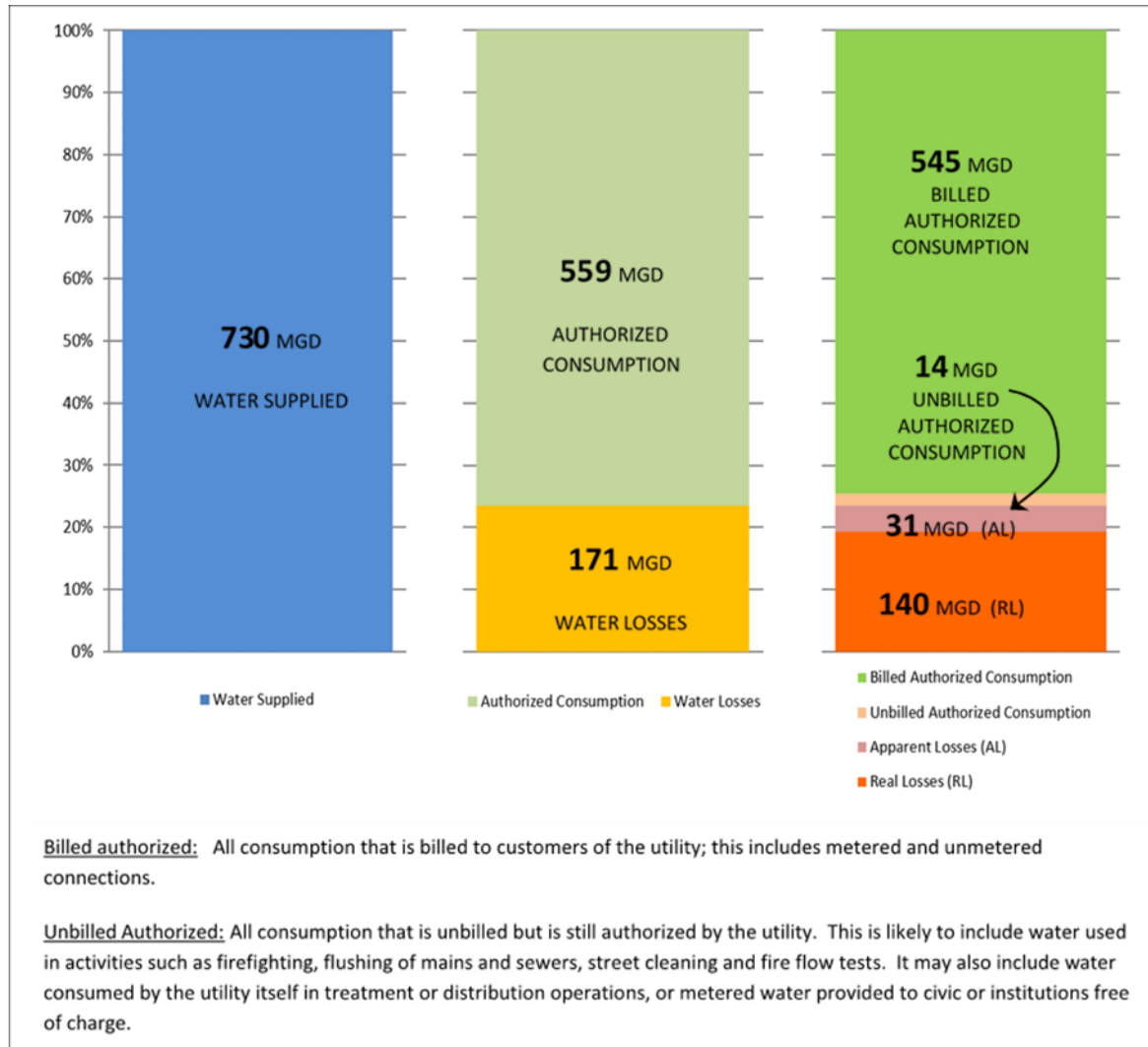


**Figure 11. Monthly withdrawals of Public Water Systems in the Basin 1990-2014. (Note that no data are shown for months where data were incomplete to avoid skewing the displayed trend line).**

In 2009, as part of DRBC's effort to ensure its regulations reflect the latest thinking in the field of water efficiency, the commission amended its Comprehensive Plan and Water Code to implement an updated water audit approach to identify and manage water loss in the basin, in partnership with basin water purveyors. The approach is consistent with the International Water Association (IWA) and American Water Works Association (AWWA) Water Audit Methodology and is considered a best management practice in water loss control. The revised regulations require PWS systems to conduct an annual water audit to help identify water losses, particularly water lost due to leaky infrastructure. DRBC performed multiple outreach efforts and the audit became a mandatory requirement in 2012. Nearly three hundred water audits were available for analysis for the CY2014 Report. Note: This dataset (276 water audits) includes 18 audits submitted in prior calendar years (i.e., 2012 and 2013), but not yet submitted for CY2014 in order to provide a more complete basinwide water use/loss assessment for 2014. Collectively, the audit data indicates that approximately 730 million gallons per day (MGD) of water was put into distribution systems in the Delaware River Basin. *Non-revenue water* is a key term used in the AWWA water audit methodology to quantify water losses and unbilled water consumption. Non-revenue water is water that has been treated and pressurized and enters the distribution system, but generates no revenue for the water purveyor. Water losses can be real losses (through leaks, also referred to as physical losses) or apparent losses (for example, through

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theft or metering inaccuracies). Based on the CY2014 reported data, an estimated 140 MGD was reported as physically lost from distribution systems in the DRB along with an estimated 31 MGD reported as apparent losses and 14 MGD of unbilled authorized consumption for a total of 185 MGD of non-revenue water reported in CY2014. This non-revenue water has an estimated value of \$132 million to water utilities in the DRB and represents a significant opportunity to improve the efficiency of public water supply in the basin. Figure 12 shows a summary of the 2014 results of data collection under the DRBC water audit program.



**Figure 12. DRBC water audit program summary (CY2014); aggregate of 276 individual water system audits.**

Data collection under the DRBC's water audit program mark a significant step in a long-term effort to improve water efficiency and promote best practices in water loss control for basin water purveyors. During the first few years of the program, the emphasis will be on ensuring that water purveyors build confidence in the data submitted in the water audit. Developing and providing accurate data to the water audit process will result in a clearer understanding of the causes of water loss and is a vital first step in the process. Furthermore, the water audit emphasizes the importance of calibrating source meters to ensure accurate measurement of water withdrawn. This also helps improve the accuracy of reported withdrawals of water to state agencies and DRBC for use in other water use studies and assessments. It is anticipated that a focus on this issue will result in an improved efficiency of public water supply systems, saving both water resources and money.

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### Industrial Withdrawals

Historic data for industrial withdrawals show a decline from levels in the early 1990's (Figure 13). The closing of the Bethlehem Steel plant in Bethlehem PA in 1995 contributed significantly to the overall decline in water use for this sector as it was the Basin's largest industrial water user. Over the past decade, industrial water use has declined slightly despite numerous facilities changing hands. Several large refineries in the Basin have seen a lot of turnover in recent years. Refineries that were idle are once again in production and have returned to more normal operations with water withdrawal data returning to previous levels.

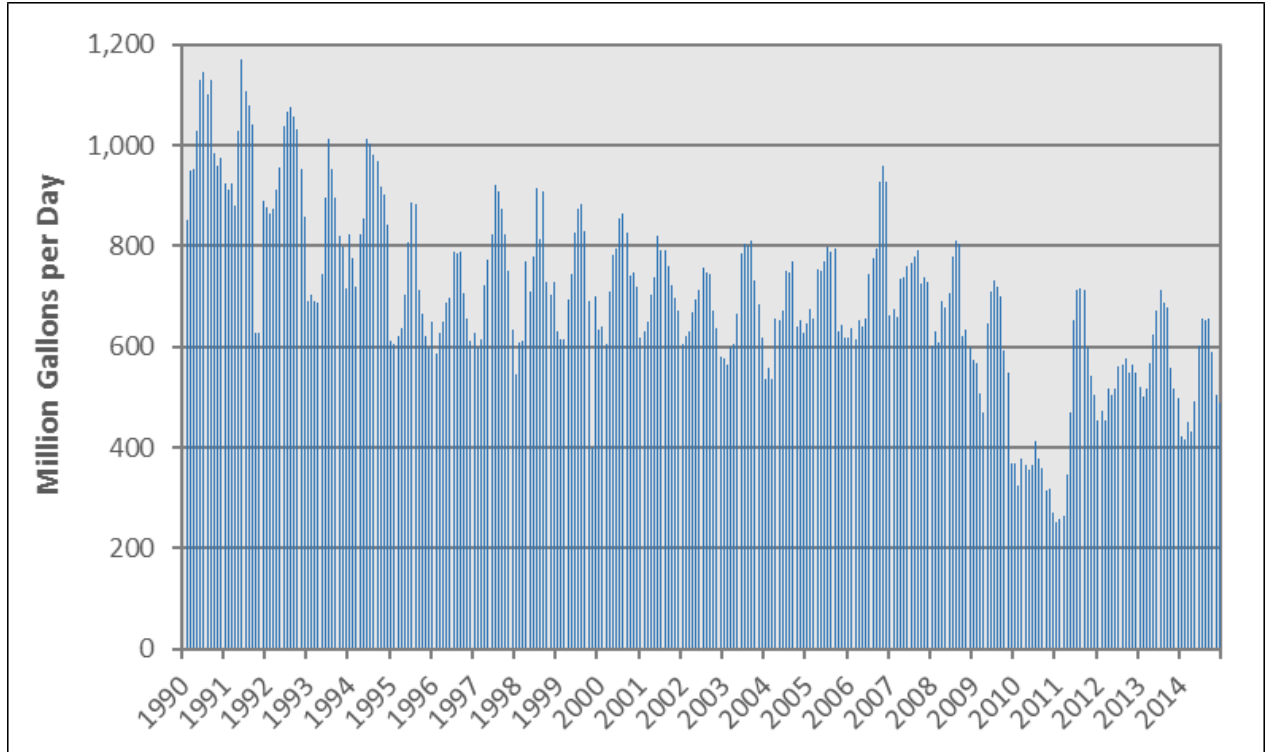


Figure 13. Monthly Industrial Water Withdrawals 1990 - 2014

### Seasonal Variation in Withdrawals and Consumptive Use

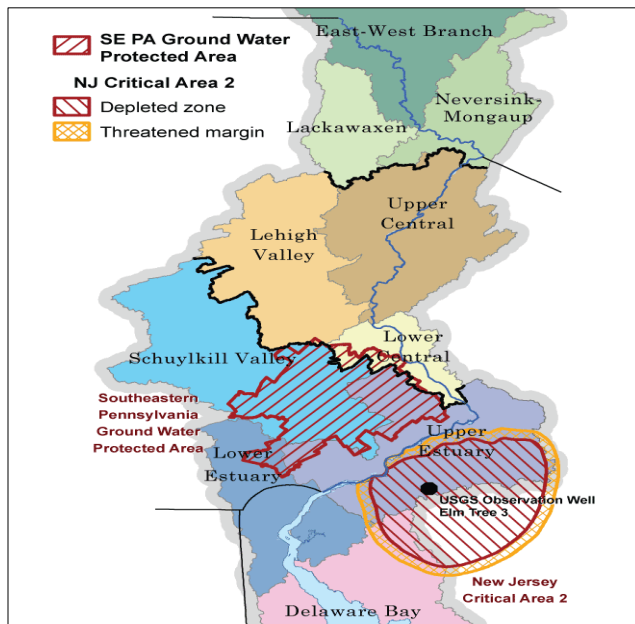
The monthly data shown in Figures 6, 7, 10, 11, and 13, highlight the extent to which water withdrawals and consumptive uses vary seasonally. Thermoelectric power generation experiences peaks in the summer months as a consequence of increased power demand for residential and commercial cooling. Simultaneously, public water suppliers experience peak demands in the summer months when lawn-watering and other outside uses are greatest. This highlights the need for including accurate seasonal (peak) considerations—including ecological (instream) needs—in long-range supply sufficiency assessments.

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### Ecological (Instream) Flow Needs

Water supply planning in the basin generally has not taken into account the instream flow needs of aquatic communities principally due to a scarcity of specific quantitative information, especially regarding the relationship of flow to ecological needs. Understanding the instream flows necessary to protect key ecological communities for the range of habitats in the Delaware River Basin is vital for the Commission to effectively manage and plan to meet future water needs for all uses. In April 2012, the Commission and The Nature Conservancy (TNC) began a year-long study to develop basin-wide ecosystem flow recommendations that can be implemented within the subwatersheds of the Delaware River. The study was completed in December 2013. The Commission is currently reviewing options to implement the TNC recommendations. The USGS WaterSMART study also includes an ecological flows component.

### Conditions in Special Groundwater Management Areas



Two areas of the Basin are included in special management programs to mitigate historical groundwater supply issues and prevent future stress. The Commission manages the Southeast Pennsylvania Groundwater Protected Area (SEPA GWPA) on behalf of the Commonwealth of Pennsylvania; New Jersey manages Critical Area 2 in the Potomac-Raritan-Magothy (PRM) aquifer system in southwestern New Jersey (Figure 14).

**Southeast Pennsylvania Groundwater Protected Area.** The SEPA GWPA is an area of 1200 sq. mi. that includes 76 subbasins closely managed by DRBC with regard to groundwater withdrawals, well interferences, and municipal water supply planning. Withdrawal limits have been established for each of the subbasins. Based on an analysis by DRBC using groundwater withdrawal data provided by the PADEP:

**Figure 14. Groundwater Management Areas in the Delaware River Basin.**

Presently, cumulative allocations in some SEPA GWPA subbasins exceed the recommended sub-basin withdrawal limit (Figure 15). In order to plan for future development and an increased demand on groundwater resources, subbasin stress determinations will be made based on docket and SEPA GWPA permit allocations. The Commission will continue to update subbasin usage with current PADEP water withdrawal data and continue to lower cumulative docket/permit allocations to below their respective subbasin withdrawal limits.

- Use in four (4) subbasins is currently between the fifty percent (50%) and seventy-five (75%), of their withdrawal limit.
- Use in one subbasin is between the (75% and 100 percent withdrawal limit, which is considered “potentially stressed”.
- One subbasin, where a major withdrawal from a quarry reservoir is counted as a groundwater withdrawal by PADEP, is above its withdrawal limit.
- For any new withdrawal in a “potentially stressed” subbasin, SEPA GWPA regulations provide alternative programs geared toward increasing the groundwater recharge to the underlying formation or that conserve overall groundwater use.

Over the past 16 years, cumulative groundwater use in the SEPA GWPA has decreased (Figure 16). This is likely to be partially attributable to improved water conservation, as noted above and also due to infrastructure changes, notably the Point Pleasant, PA diversion of surface water from the Delaware River



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to offset groundwater use by communities in Bucks and Montgomery counties. Figure 16 shows groundwater withdrawal data provided by the PADEP covering the years 1987 through 2012. The groundwater withdrawal data reported in the graph are from facilities that submitted data to the PADEP.

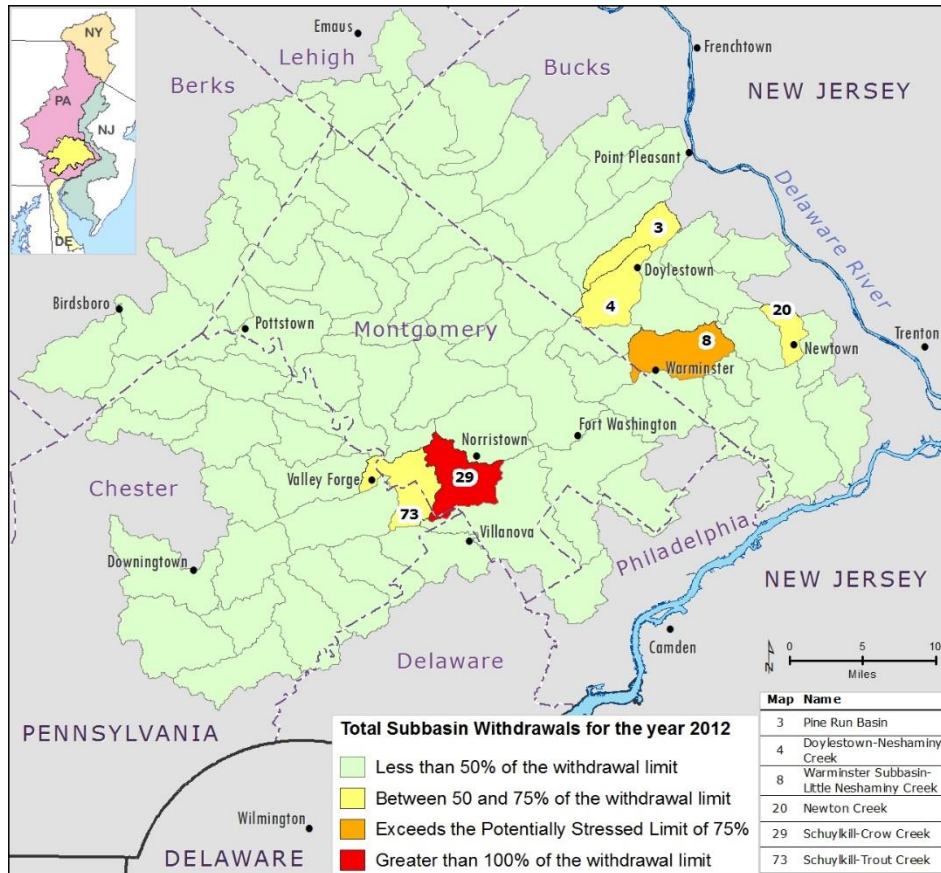


Figure 15. Four (yellow) subbasins are currently between 50% and 75% of the withdrawal limit; one sub-basin (orange) is between 75% and 100% of its limit and considered potentially stressed; and one subbasin, where a major withdrawal from a quarry reservoir is counted as a groundwater withdrawal by PADEP, is above its withdrawal limit.

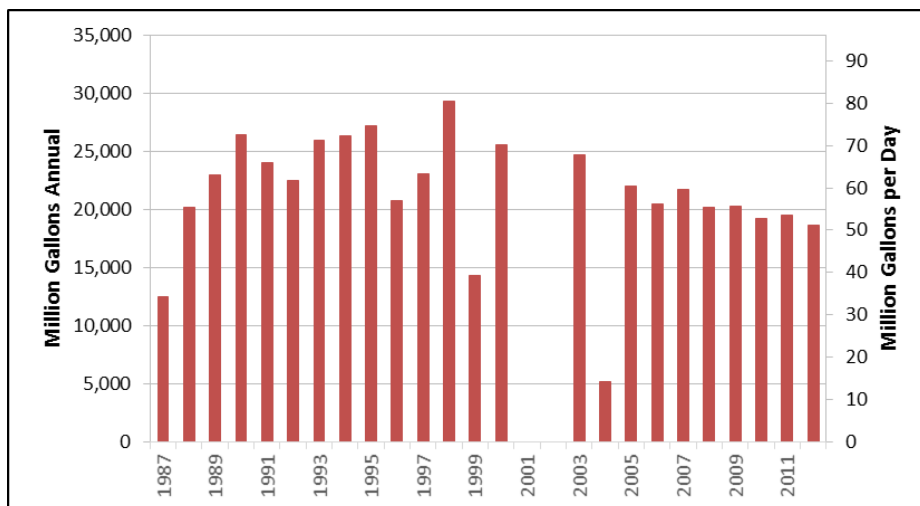
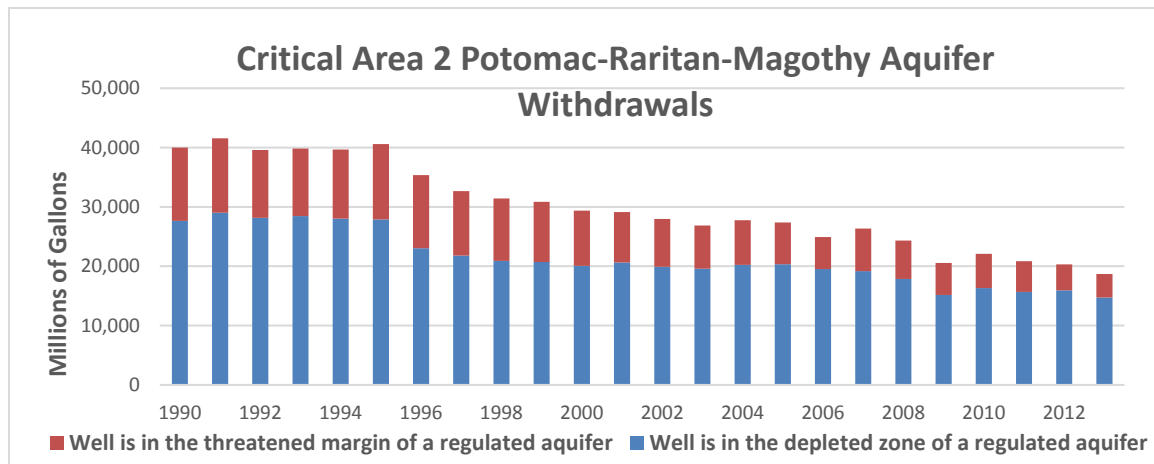


Figure 16. Withdrawals in the PA Groundwater Protected Area 1987-2012 show reductions over the past 15 years.

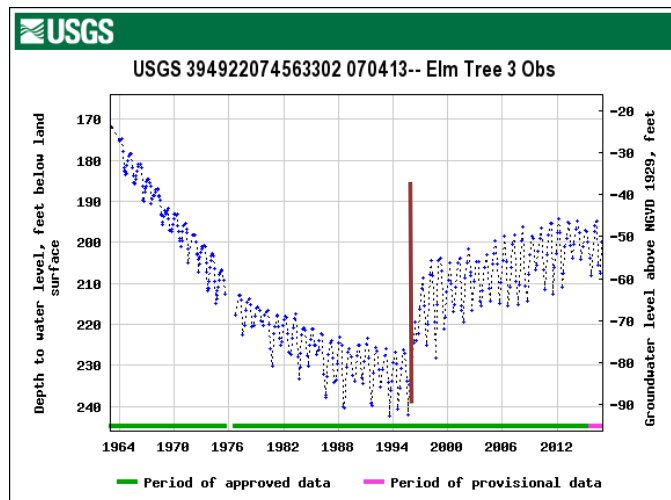


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**New Jersey Critical Area 2.** NJDEP and USGS regularly monitor groundwater levels in the affected aquifers of Critical Area 2 (CA2) in southern New Jersey, and assessments indicate that withdrawals have significantly decreased beginning with the program's inception in 1996 (Figure 17), resulting in concurrent rebounding of groundwater levels in most monitoring wells (Figure 18). The surface water diversion/treatment facility on the Delaware River in Delran, Burlington County, owned and operated by the New Jersey American Water Company, was chosen as the regional water supply alternative for Critical Area 2. The Tri-County Water Supply Project remains the primary water source to meet growing water demands in the region. The downward trend that is visible in Figure 17 is the result of major infrastructure improvements to allow areas that were previously solely reliable on local PRM withdrawals to tap into the regional solution of the Delaware River Tri-County project which is primarily a surface water withdrawal. In addition, water conservation and indoor plumbing efficiencies as well as economic and business trends add to the overall downward trend in water withdrawals.



**Figure 17.** Withdrawals from the PRM 1990-2011 show significant reductions since the inception of Critical Area 2 management in 1996. Source: S. Domber, NJDEP, Sept 2015.



**Figure 18.** Example of rebounding groundwater levels in the upper PRM of NJ Critical Area 2 since program inception in 1996 (vertical line). Elm Tree 3 observation well Burlington Co., NJ. Source: USGS, Jan. 2017.

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### Areas of Concern: PRM and Bayshore Watersheds

The 2007 report of a multi-year investigation by the USACE concluded that groundwater withdrawals in northern New Castle County, Delaware, were reducing local stream base flows and forming cones of depression. Pumping in Delaware is increasing groundwater flow from Maryland and decreasing flow into New Jersey by about 10% each<sup>3</sup>, and regional pumping has created overlapping cones of depression across the study area of the three states.

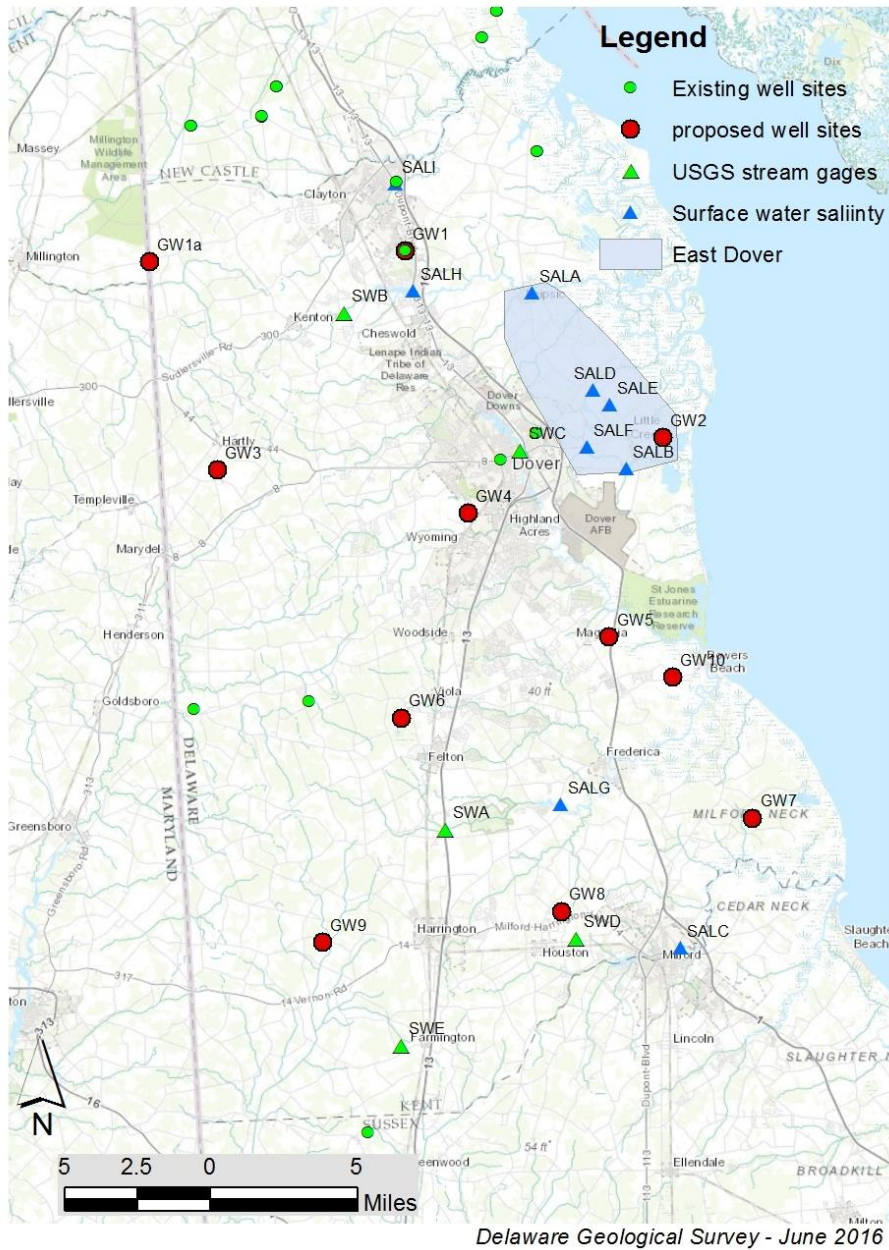
**Delaware.** Critical water resource issues in the Rancocas, Piney Point, Cheswold, Federalsburg, Frederica, and Columbia aquifers of Kent County, DE have driven state capital funding of a multi-year program in Delaware to improve groundwater monitoring and the collection of detailed, baseline hydrologic information to inform near-term (e.g., 10 year) management options (see Figure 19). Monitoring wells will be installed in multiple aquifers at ten sites, and two USGS stream gaging stations will be re-activated. A focused effort will be made to improve monitoring infrastructure in the Columbia aquifer in the east Dover area where increased pumping for irrigation and the City of Dover are causing concerns for increased drawdown and saltwater intrusion. Salinity sensors will be installed near head of tide in several streams to provide information on the duration, intensity and frequency of saline water incursion. The project will make intensive use of automated instruments for collection of groundwater and surface water level, salinity, and temperature data. Plans also include collection of two rounds of groundwater quality sampling.

The project will be a collaborative effort of the Delaware Geological Survey (DGS), USGS, Delaware Department of Natural Resources and Environmental Control (DNREC), and the Governor's Water Supply Coordinating Council (WSCC). The project will provide critical information on aquifer water quality conditions, yields, and pumping interactions to improve planning and provide management options for growing water demand in this region.

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<sup>3</sup> USACE 2007 report on results of groundwater modeling of the Potomac aquifer:  
*Updated Draft Groundwater Model Production Run Report, Upper New Castle County Delaware.*  
Prepared for DE DNREC by USACE Philadelphia District; Feb. 2007.

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**Figure 19. Proposed monitoring sites for Groundwater and Saline Water Intrusion Monitoring Network Infrastructure Improvements: Kent County, Delaware. Source: S. Andres DGS, Oct. 2016.**

**New Jersey beyond Critical Area 2.** NJDEP reports that significant demands for additional water have materialized south of Critical Area 2 (CA2). If all increased demands were met by withdrawals from the Potomac Raritan Magothy (PRM) aquifer, they might lower groundwater levels significantly and accelerate salt-water intrusion. Addressing these impacts could require an expansion of the CA2. NJDEP commissioned a USGS study of the PRM Aquifer System in Gloucester and Northeastern Salem Counties due to these concerns. The resulting study, USGS SIR 2011-5033, validates these concerns. To forestall the adverse impacts, NJDEP is allowing only limited increases in PRM withdrawals in this area. Increased demands for potable water are being directed to CA2 regional alternatives, if possible. NJDEP is steering increased non-potable demands to reuse opportunities or sources other than the PRM. A second area of concern in New Jersey is the Upper Maurice River basin. USGS Scientific Investigations Report (SIR) 2005-5105 indicates that low flows in the Maurice River show a downward trend. NJDEP commissioned a USGS study of the watershed due to concerns about increasing demands for water from the Kirkwood-Cohansey

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aquifer. The resulting study, USGS SIR 2005-5258, indicates that if existing allocations from the Kirkwood-Cohansey aquifer were fully utilized, base flow in the Maurice River at Norma, N.J. would see significant reductions and could cease during periods of drought. Based on this analysis, New Jersey has not been approving applications for additional depletive portions of allocations from the Kirkwood-Cohansey aquifer and surface water upstream of Union Lake in order to prevent exceeding the aquifer's ability to yield groundwater and to limit adverse impacts on stream flow. Requests for increased withdrawals are redirected to sources that will not impact streamflow.

**Bayshore Supply Alternatives.** A limited number of water supply alternatives are available for this area. Non-critical, confined aquifers are one option, but these may be limited depending on the magnitude of the diversion (e.g., Piney Point, Mt. Laurel-Wenonah) or by water quality problems (e.g., salt water in the Mt. Laurel-Wenonah). New Jersey American Water's tri-county pipeline, originally developed as an alternative source of water for the stressed municipalities in Critical Area 2, has now been extended through much of Gloucester County, including Logan, Harrison, East Greenwich, Woolwich, Pitman, and Elk Townships.

### **National Groundwater Monitoring Network**

The National Ground-Water Monitoring Network (NGWMN) is a consortium of state and local agencies and the USGS that was established to create a single point of access for scientists, engineers, policy makers, and the public to view and acquire important physical and chemical data on the nation's groundwater resources. NJDEP has contributed data to the NGWMN since 2011 and DGS became a data provider for in early 2016. The network will ultimately allow users to view groundwater data across state lines to observe trends in groundwater quality and availability in a local, regional or national context. NGWMN resources are managed by the USGS Center for Integrated Data Analytics and can be accessed at <http://cida.usgs.gov/ngwmn/>.

### **GENERAL STATEMENT OF BASIN SUPPLY SUFFICIENCY**

Based on current and anticipated ground and surface water withdrawals, coupled with current operating restrictions (conservation releases, pass-by flows, consumptive use make-up, etc.) there is an adequate supply of water to meet both demand in the Basin and permitted exports from the Basin under normal conditions. Under medium risk conditions, e.g., 7-day average, one-in-ten-years (7Q10) low flow, demands can generally be met, except in a few sub-basins and select locations on the Schuylkill River. However, streamflow objectives and out-of-Basin diversions may not be able to be maintained during a recurrence of the 1960's drought (the drought of record in the Delaware River Basin), a rare occurrence.

Furthermore, groundwater in both NJ Critical Area 2 and the SEPA Groundwater Protected Area remains under close scrutiny, and conjunctive use of surface water is both recommended and, in some locations, necessary. More in-depth analysis and investigation is needed to provide a detailed forecast of supply adequacy during a repeat of the drought of record, under modified operating restrictions, or under different climatic conditions. The Commission proposes over the next three years to prepare a supply assessment under various scenarios and make recommendations for a Sustainable Water Future through 2060.

Recent studies by the US Army Corps of Engineers (USACE) have highlighted potential structural inadequacies in the Blue Marsh and Beltzville reservoirs, issues that will need to be addressed. The stored water is released to maintain minimum flows immediately below the reservoirs (conservation releases) and to support flow objectives (e.g., Delaware River at Trenton). DRBC is responsible for the annual debt service and a portion of operation and maintenance costs. These costs are reimbursed from the DRBC water supply charging program.

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### C. SURFACE WATER QUALITY

#### Surface Water Quality Assessment

Two major water quality assessments describe the water quality of the Delaware River Basin: The *Technical Report for the State of the Estuary / State of the Basin* completed in 2012, and the *2016 Delaware River and Bay Water Quality Assessment Report*. These two reports complement each other by utilizing different approaches to assess water quality.

**Table C1. Comparison of Water Quality Assessment Reports**

Comparison	Water Quality Technical Report for the State of the Estuary / State of the Basin	2016 Delaware River and Bay Water Quality Assessment
Evaluation Method	Use of Indicators	Compare observations to DRBC Criteria
Assessment	Current status, long term trends, future predictions	Supporting or not supporting
Term	10-year data window for current status, full period of record for long term trends	5-Year data window
Extent	Entire basin	Mainstem Delaware River only

#### ***Technical Report for the State of the Estuary / State of the Basin - Chapter 3: Water Quality.***

This report, facilitated by the Partnership for the Delaware Estuary and co-authored by many partners including the DRBC, provided an assessment of water quality indicators for the entire basin, with special emphasis on the estuary. The technical report differed from, and complemented the 2016 Water Quality Assessment Report, in that it focused on metrics for which no criteria have been developed and evaluated long term trends. The Water Quality Technical Report--Chapter 3 of the Technical Report for the State of the Estuary and Basin (TREB) - is available at: [www.delawareestuary.org/pdf/TREB/Chap3.pdf](http://www.delawareestuary.org/pdf/TREB/Chap3.pdf). The full TREB report is available at: [www.delawareestuary.org/technical-report-delaware-estuary-basin](http://www.delawareestuary.org/technical-report-delaware-estuary-basin).



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### 2016 Delaware River and Bay Water Quality Assessment



The Water Quality Assessment (previously called the Integrated Assessment) performed by DRBC focuses on the mainstem Delaware River, comparing observations to water quality criteria to determine whether water quality is sufficient to support designated uses. Designated uses for the River include: Aquatic life, Public Water Supply, Recreation, Fish Consumption, and Shellfish Consumption, although not all uses are designated in all water quality zones (see Figure 20). Assessments to determine support of the designated uses of the Delaware River are reported in the 2016 Delaware River and Bay Water Quality Assessment at:

<http://www.nj.gov/drbc/quality/reports/wq-assessment-rpts.html>

Figure 20. Delaware River Basin Water Quality Zones

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### GENERAL STATEMENT OF BASIN WATER QUALITY

Overall, water quality in the Delaware River and Bay is good, with the majority of observations meeting criteria.

**Aquatic Life.** Support of the aquatic life designated use is assessed by evaluation of dissolved oxygen, pH, turbidity, temperature, TDS, alkalinity, toxic pollutants, and biology. The majority of observations met water quality standards. Additional detail on select portions of the assessment in support of Aquatic Life is provided below:

#### Conventional Pollutants

- **Dissolved Oxygen.** The vast majority of the measurements met criteria. All criteria were met in Zones 1A, 1E, 3, and 4. In Zones 1C and 1D, all instantaneous minima criteria were met. All seasonal mean criteria were met in Zones 2 through 5. The majority of observations met minimum or 24-hour mean criteria in all Zones.
- **pH.** Criteria were mostly met, with the exception of Zones 1A, 1B, and 1E, where daily pH maximum values routinely exceeded the maximum criterion of 8.5.
- **Turbidity.** The majority of observations met criteria for turbidity in all Zones.
- **Temperature.** As noted in previous assessments, temperature criteria in Zones 1A through 1E are clearly oriented toward determining compliance of thermal mixing zones for point discharges. In July 2016 DRBC presented options for development of new temperature criteria to its Water Quality Advisory Committee (WQAC) for discussion at meetings in 2017. In Zones 3 through 6, the majority of observations met criteria. In Zone 2, approximately 87% of observations met criteria. Atmospheric temperatures and meteorological conditions are strong drivers of water temperature.
- **Toxic Pollutants**
  - **Copper.** Data showed multiple exceedances in Zone 5 of the chronic freshwater criterion for copper using the DRBC regulatory hardness of 74 mg/L CaCO<sub>3</sub> in the hardness based criteria equation but not more than one exceedance in three years when site specific hardness are used. Multiple exceedances of DRBC acute and chronic marine stream quality objectives were observed for copper in Zones 5 and 6. Assessment is complicated by factors such as field sampling and analytical issues with contamination, the applicability of DRBC's freshwater or marine criteria, a need to assess revisions to the current freshwater and marine criteria, and the influence of other water quality attributes that influence the partitioning and toxicity of copper.

Exceedances of acute and chronic freshwater objectives for the support of aquatic life for dissolved copper were reported two times in Zone 1A and one time in Zone 1B, two acute exceedances and six chronic exceedances in Zone 1D computed with paired site specific hardness measured concurrently with the toxic analytical parameter and compared to numeric criteria values calculated with hardness measured at the nearest interstate control point (ICP) The apparent exceedances are low in both frequency and magnitude. For total copper measurements compared to total copper criteria (using conversion factors) one exceedance in Zone 1D and one in Zone 1E are observed.

- **Aluminum.** Data showed multiple exceedances of aluminum acute and chronic freshwater objectives for the support of aquatic life in Zone 4. Exceedances of acute and chronic criteria freshwater objectives for the support of aquatic life in Zone 1 for aluminum.

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- **Cadmium.** Exceedances of acute and chronic criteria for cadmium freshwater objectives for the support of aquatic life in Zone 1B if *J flagged*<sup>4</sup> data and samples with hardness < 25 mg/L are include in the assessment. No impairment with unflagged data.

**Public Water Supply.** Support of the Public Water Supply designated use is assessed by evaluating TDS, Hardness, Chlorides, Odor, Phenols, Sodium, Turbidity, Systemic Toxicants, Carcinogens, and Drinking Water Closures. The majority of observations met water quality standards for all parameters except certain carcinogens and systemic toxicants.

- Exceedances of human health objectives (carcinogens) for total PCB in Zones 1A, 1B, 1D and 1E. PCB were not monitored in Zone 1C.
- Exceedances were found in Zones 2 through 5 of human health objectives (carcinogens) for pesticides: DDD; DDE; DDT and Dieldrin in a 2012 low detection limit study using High Resolution GC/MS methods. Surface water was collected only once (a single day) which is insufficient to assess if stream quality objectives for the Delaware River were met. Exceedances were found in Zone 4 and 5 of human health objectives (carcinogens) for the pesticide heptachlor epoxide in a 2012 low detection limit study using a High Resolution GC/MS method. Surface water was collected only once (a single day) which is insufficient to assess if stream quality objectives for the Delaware River were met.
- Exceedances of human health objectives (systemic) for mercury in Zone 1B.

**Recreation.** The DRBC water quality regulations sub-divide Zone 4 for bacteria criteria. The upper portion of Zone 4, above River Mile 81.8, is designated as secondary contact recreation only, while the lower portion of Zone 4, below River Mile 81.8, is designated for both primary and secondary contact recreation. Primary contact recreation is supported in all applicable Zones, except Zone 4 below RM 81.8, where there is insufficient data. Secondary contact recreation is supported in Zones 3 and 4.

### **Fish Consumption.**

The fish consumption designated use applies to all DRBC WQM Zones. The assessment criterion is based primarily on the presence of the Basin states' fish consumption advisories in the mainstem Delaware River and Bay for the assessment period. The presence of fish consumption advisories results in an assessment of "not supporting the designated use." Advisories were issued for each assessment unit. There is no assessment unit without an advisory, so the use is not supported in any zone.

EPA approved a total maximum daily load (TMDL) for PCBs for Zones 2 through 5 in December 2003, and a second PCB TMDL for Zone 6 in December 2006. TMDLs are expected to be revised by USEPA in 2017 based on documentation prepared by DRBC staff.

**Shellfish Consumption.** Shellfish consumption, as a DRBC designated use, only applies to DRBC Zone 6. For the 2016 assessment, approved harvesting areas were considered to be supporting the use. Prohibited waters were considered to be not supporting the use. Assessment units classified as special restricted and seasonally restricted are considered to be supported, but with special conditions. In total for the 2016 assessment, 616 mi<sup>2</sup> are in full support (82.4% of zone 6), 35.4 mi<sup>2</sup> are supporting with special conditions (4.7%), and 96.1 mi<sup>2</sup> are not supporting the shellfish consumption use (12.9%).

### **Antidegradation: DRBC Special Protection Waters**

In recent years, three major advancements have been achieved in the Special Protection Waters program:

- The Lower Delaware Measurable Change Assessment 2009-2011 (DRBC 2016) was completed. This was DRBC's first assessment of measurable change since site-specific existing water quality (EWQ) targets were established in DRBC rules. Methods for determination of measurable change were successfully applied, showing that water quality has not degraded, and in many cases has

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<sup>4</sup> *J Flagged* means the reported result is an estimate. The value is less than the minimum calibration level but greater than the estimated detection limit (EDL).



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improved. Only chlorides and specific conductance exceeded water quality targets at almost all sites, but both are still far better than water quality standards. The cause for this increase is believed to be winter road salting. Notable water quality improvements were observed in the Delaware, Lehigh and Musconetcong Rivers, where nutrient concentrations declined. This publication is available online at

[http://www.nj.gov/drbc/library/documents/LowerDel\\_EWQrpt\\_2016/LDel\\_EWQrpt\\_2016\\_entire.pdf](http://www.nj.gov/drbc/library/documents/LowerDel_EWQrpt_2016/LDel_EWQrpt_2016_entire.pdf)

and as a story map at

<http://drbc.maps.arcgis.com/apps/MapSeries/index.html?appid=e63f5f1320794666a7def165ff9ae0e4>

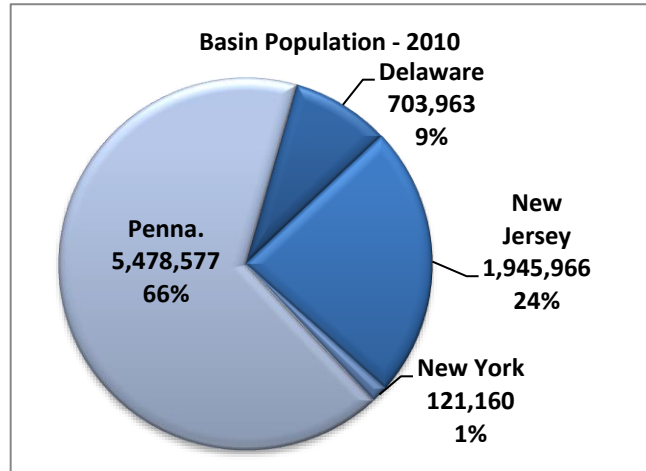
- Site-specific EWQ targets have been developed for all Upper, Middle and Lower Delaware sites. There are currently 85 Delaware River and tributary sites. EWQ is documented in the Existing Water Quality Atlas of the Delaware River Special Protection Waters (DRBC 2016). Data were compiled from the DRBC/NPS Scenic Rivers Monitoring Program (SRMP) monitoring results; three USGS water quality investigations (Hickman and Fisher 2008; Siemion and Murdoch 2010; and Senior in press); and state monitoring results from PADEP, NJDEP and NYSDEC. This publication is available online at [http://www.nj.gov/drbc/programs/quality/spw\\_ewq-atlas.html](http://www.nj.gov/drbc/programs/quality/spw_ewq-atlas.html).
- Water quality models have been developed, calibrated, and are utilized for watershed-wide cumulative evaluations of wastewater projects for four regions: the Lower Delaware; the Lehigh River watershed; the Brodhead Creek watershed; and the Neversink River watershed. These models are regularly updated and used for No Measurable Change (NMC) evaluations of new or expanding wastewater facilities in DRBC's permitting process.

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### D. POPULATION AND LANDSCAPE

The following statistics are based on the 2010 US Census; the county population figures are for 2015, are not corrected for the basin boundary and should be considered provisional. The next full census will be undertaken in 2020.

- The population (Figure 21) of the basin increased by nearly one half million people, from 7.76 million in 2000 to nearly 8.26 million in 2010 (increase of 6.3%). Between 2010 and 2015, the counties within or straddling the basin added an additional 240,500.
- If compared with the fifty states, the basin would rank 11<sup>th</sup> in population behind New Jersey and ahead of Virginia based on 2010 census data.
- Continued population growth at 6.3% per decade will mean an increase of 35.7% to 11.2 million people by 2060.
- The greatest concentration of developed land (and population density) continues to be in the Lower Region of the basin - the greater Trenton-Philadelphia-Camden-Wilmington area.



**Figure 21. Basin Population 2010. Pennsylvania accounts for approximately two-thirds of the basin's population. (Note: An additional 7 million people outside of the basin who rely on basin water supplies are not included in this figure).**

Between 2010 and 2015, the population in eight basin counties increased by 10,000 or more, including all three counties in Delaware and five counties in the Schuylkill watershed. Growth in the Delaware counties of Sussex and Kent are entirely dependent on groundwater, whereas the other growing counties have greater availability of water supply infrastructure and conjunctive use of source supplies.

State	County	2010	2015	Change	% Change
PA	Philadelphia	1,528,458	1,593,074	64,616	4.2%
DE	New Castle	538,870	555,779	16,909	3.1%
PA	Montgomery	801,134	817,719	16,585	2.1%
PA	Chester	499,739	516,183	16,444	3.3%
DE	Sussex	197,897	214,075	16,178	8.2%
PA	Berks	411,791	425,383	13,592	3.3%
PA	Delaware	559,373	572,676	13,303	2.4%
DE	Kent	162,949	174,025	11,076	6.8%

Similarly, eight basin counties lost population: five in New Jersey, two in Pennsylvania and one in New York. Pike County PA, which in previous years was one of the fastest growing counties in the PA and the basin, is losing population. Also, unlike their counterparts across the bay in Delaware, the New Jersey Bayshore counties (Cape May and Salem) are losing population.

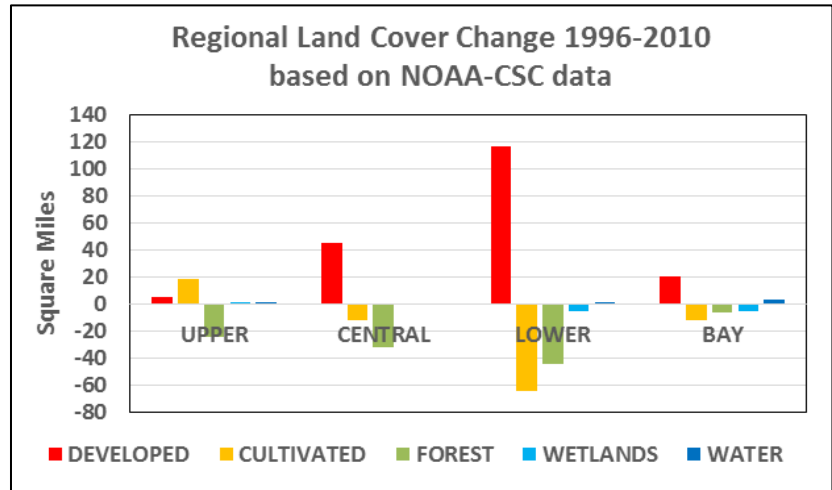
State	County	2010	2015	Change	% Change
NJ	Cape May	97,265	95,443	-1,822	-1.9%
NJ	Sussex	149,265	147,557	-1,708	-1.1%
NJ	Salem	66,083	64,928	-1,155	-1.7%
NJ	Hunterdon	128,349	127,385	-964	-0.8%
PA	Pike	57,311	56,544	-767	-1.3%
PA	Carbon	65,204	64,470	-734	-1.1%
NJ	Warren	108,692	108,332	-360	-0.3%
NY	Delaware	47,980	47,623	-357	-0.7%

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Landscape change occurs incrementally, but is nonetheless worth tracking, since landscape conditions can affect water resources. In the years between 1996 and 2010, the landscape has changed, although in the aggregate not dramatically. Net changes are summarized below and regional shifts in land cover are illustrated in Figure 22.

- Developed land now covers nearly 2100 square miles, more than 16% of the basin
- Natural landscapes (e.g., forests, wetlands) cover slightly less than 60% of the landscape.
- Forested land, once a dominant feature, now accounts for less than half of the basin land cover and decreased by more than 100 square miles (approx. 68,460 acres) between 1996 and 2010. Continued loss of forest, crucial to sustaining water quality and availability, could have a negative impact on the long term condition of the basin's water resources.
- Changes in wetlands appear to be less dramatic since no-net-loss policies have minimized losses from development activity. However, coastal wetlands face the threat of inundation from rising sea levels exacerbated by an inability to migrate inland where trapped by existing developed land.
- Cultivated (agricultural and transitional scrub shrub landscapes) land experienced a net decrease during the period in all but the Upper region of the basin.

Estimates of future population will drive both direct (potable supply) and indirect (energy-related, industrial) needs for water. Estimates of future land use/land cover and its implications for future water supply needs will be developed as part of the USGS National WaterSMART program and integrated into the Sustainable Water Future 2060 project.



**Figure 22. Regional Net Change in Land Cover 1996-2010 illustrates the magnitude of change and the net gains/losses in land cover in the four basin regions. Forest loss was experienced across the basin. Based on analysis of satellite imagery from NOAA Coastal Services Center.**

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### **E. EMERGENT ISSUES**

#### **Natural Gas Extraction in the Upper Basin**

Explorative and extractive drilling for natural gas in the Marcellus Shale and other formations in the Delaware River Basin are activities that could affect water resources. Work Program tasks related to natural gas activity are found in the Special Section of II.

#### **LINEAR INFRASTRUCTURE (PIPELINES, ELECTRIC TRANSMISSION LINES)**

The development of natural gas extraction wells outside of the Delaware River Basin (Basin) has resulted in the modification and/or expansion of existing natural gas pipelines in the Basin and the construction of new natural gas transmission pipelines and supporting infrastructure (Compressor stations, etc.) in and through the Basin. The Commission has received, reviewed, and approved several applications in FY 2016, and additional transmission lines are proposed. Several transmission lines are proposed to convey the liquid by-products from the gas wells to refineries and markets in the Basin. In addition to the natural gas transmission lines, the Basin has experienced the reconstruction and or expansion of electric transmission lines. In part the replacement of the existing infrastructure is due to its age, the need to improve delivery system reliability and redundancy, and to meet the growing demand of the Northeast United States. These projects traverse the basin and have the potential to impact water resource landscapes, including headwater watersheds and riparian corridors, as well as water quality. Work Program tasks related to linear infrastructure are found in the Special Section of II.

#### **Other Energy Issues**

Energy generation and transmission also introduce the potential for impacts to water resources. Among the projects that are under observation by DRBC are:

- The transition from once-through to evaporative cooling as existing or new power stations add capacity.
- Additional nuclear generating stations proposed within the DRB that will require a substantial volume of water for evaporative cooling.
- New natural gas power plants that are being proposed throughout to take advantage of cheaper, more regional sources of natural gas.
- Liquefied Natural Gas (LNG) proposals that would convert natural gas from regional or other locations into a liquid form for local use, and/or export to other areas of the country or overseas.

#### **CHANGING CLIMATE**

There is potential for changes to water resources in the Basin due to changes in climate and shifting regional weather patterns. While the science continues to evolve, several climate models predict that basin temperatures will increase, precipitation will stay the same or increase, and sea level will rise. Precipitation is predicted to occur in the form of fewer, more intense storms occurring in the winter months. This means a potential increase in flood events coupled with extended drought cycles. Increased temperatures will affect evapotranspiration rates and stream water quality. Turbidity levels will likely increase and dissolved oxygen levels decrease. Sea level rise may require increased releases from storage to augment river flows to repel salinity and/or costly modifications by water suppliers to treat increases in dissolved solids. Climate change could also affect instream flow and temperature conditions for aquatic biota. Work Program tasks related to water supply planning under future (2060) conditions, including potential climate change, are found in Section II.

#### **PERFLUORINATED COMPOUNDS**

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are a diverse group of compounds that have varying degrees of persistence, toxicity and bioaccumulation in the environment. They are found in a variety of industrial and household products such as stain repellant textiles, fire-fighting foams and paper coatings. They have unique properties to repel both water and oil. While there is still much to be learned about the effects of PFAS on human and ecological health, exposure from drinking water is a concern. In November 2016, EPA issued a revised health advisory for PFOA and PFOS, the most extensively produced and studied of the PFAS.<sup>[1]</sup> Both substances have been detected in drinking water wells in basin states. DRBC

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<sup>[1]</sup> See EPA Fact Sheet 800-F-16-003 [https://www.epa.gov/sites/production/files/2016-06/documents/drinkingwaterhealthadvisories\\_pfoa\\_pfos\\_updated\\_5.31.16.pdf](https://www.epa.gov/sites/production/files/2016-06/documents/drinkingwaterhealthadvisories_pfoa_pfos_updated_5.31.16.pdf)

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will continue to work with the States and communities to identify alternative drinking water sources when necessary. Available data for surface water show PFOA and PFOS levels are below current EPA and basin state human health advisory levels in segments of the Delaware River designated as drinking water sources. PFAS are contaminants of emerging concern that warrant further study. DRBC staff and the Toxics Advisory Committee (TAC) continue to review and assess PFAS in the Delaware River. For additional information see Contaminants of Emerging Concern on the DRBC website at <http://www.nj.gov/drbc/quality/reports/cecs.html>.

### **ATLANTIC STURGEON**

Effective in April 2012, four geographically distinct populations of Atlantic sturgeon, including those of the New York Bight—which includes the Delaware River—were listed as endangered. Mature Atlantic sturgeon migrate from the sea to fresh water in advance of spawning, and juveniles remain in fresh water for several years. Once abundant in the tidal Delaware River, spawning adults are believed to currently number fewer than 300. The Endangered Species Act requires species listed as endangered to receive the full protection under the Act to prevent extinction, including a prohibition against “take,” which includes harassing, harming, pursuing, wounding, killing, trapping, capturing, or collecting. Long term strategies include providing habitat that will support spawning and population recovery in the Delaware Estuary; these strategies may have implications for certain stream quality objectives. For additional discussion, see Section 1.4.2.A.2.

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### **II. WATER RESOURCE MANAGEMENT**

#### **Summary of the activities and programs constituting the work plan for FY 2017-2019**

##### **A. GOALS AND PRIORITIES**

The key water resource goals of the DRBC are:

- An adequate and sustainable supply of water for the Basin.
- Clean and healthy water resources throughout the Basin.
- Reduction of losses and impacts in areas prone to flooding within the Basin.

##### **COMMISSION FOCUS AREAS**

###### **1. Water Quantity**

- Perform modeling analyses for 2060 Sustainable Water Resources, including climate change considerations and pilot studies of Lehigh and Schuylkill watersheds. Begin pilot for the Brandywine watershed.
- Support Decree Parties as they evolve the Flexible Flow Management Program (FFMP)
- Manage DRBC storage for salinity repulsion and monitor hydrologic conditions that may require Commission action.
- Coordinate drought management actions with States, reservoir operators and facilities with consumptive use replacement requirements.
- Evaluate and modify Water Code, where necessary, to reflect lessons learned from the drought conditions of 2016-2017.
- Develop Instream Flow Policy process in collaboration with state and federal agencies.
- Collaborate with ongoing federal efforts and utilize resulting products: USGS Water Census, USACE Corps Water Management System (CWMS).
- Engage stakeholders in discussions on ways to improve flood warning in the basin and discuss on-going mitigation efforts within the states.
- Develop updated water efficiency standards using USEPA WaterSense standards and/or Energy Star Certification.

###### **2. Water Quality**

- Implement water quality program (monitoring, assessment, and modeling) supported by EPA Section 106 grant in the Special Protection Waters (SPW) and Delaware Estuary.
- Collaborate with EPA and the basin states to implement PCB TMDL and complete establishment of Stage 2 TMDLs and revised implementation requirements.
- Finalize process for updating the designated use with associated Dissolved Oxygen criteria for Zones 3, 4 and the upper portion of 5.
- Develop and calibrate estuary eutrophication model including collection of necessary data.
- Complete coordination with advisory committees to recommend updates to DRBC water quality regulations for the main stem for key parameters, such as temperature and ammonia.

###### **3. Regulatory Function**

- Review applications and issue dockets/permits for projects under DRBC lead.
- Develop/update and implement the One Permit Program and associated administrative agreements (AAs) for collaborative permitting and technical coordination of state NPDES permits and water withdrawals.
- Enforce conditions of dockets/permits through compliance program.

###### **4. Collaborate with regional/state watershed partners: Partnership for the Delaware Estuary, Schuylkill Action Network, Christina Basin, Common Waters, Coalition for the Delaware River Watershed, National Park Service Wild and Scenic Rivers program, and state and federal committees/councils.**

###### **5. Agency Fiscal Management**

- Water Withdrawal and Discharge Project Fees: Complete rulemaking process updating the fee structure for review of project applications and coordination with state permitting programs.
- Re-establish and/or maintain signatory party contributions.

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### **B. WATER RESOURCE MANAGEMENT WORK PROGRAM**

#### **SPECIAL SECTION: NATURAL GAS AND RELATED INFRASTRUCTURE**

DRBC staff will support the development and advancement of natural gas regulations and related infrastructure guidance consistent with leadership on this matter at the Commissioner level including the following activities as directed:

##### **1. Natural Gas Development Regulations**

Based on Commissioner level leadership, staff will continue to review, revise or redraft, as necessary, the previously published draft Natural Gas Regulations. Staff will provide support to the process leading up to an action on the regulations by the Commissioners.

##### **2. Comment and Response Document**

As appropriate, based on Commission action, staff will prepare a Comment and Response Document that addresses public comments made on the draft Natural Gas Regulations.

##### **3. Guidance Materials**

As appropriate, based on Commission action, staff will prepare guidance materials necessary for the implementation of natural gas regulations. Guidance documents are planned for natural gas development plans, water and wastewater accounting, monitoring, treatability studies, financial assurance, fracture chemical disclosure, and post-hydrofracture reporting. Guidance materials will be considered for linear infrastructure as well and as directed.

##### **5. GIS Based Tools**

Staff and contractors will complete the preparation and/or acquisition of GIS base layers for high-value water resource landscapes (HVWRLs). GIS data acquisition includes the delineation of first order stream catchments (headwaters) in the Basin from USGS.

##### **6. Program Implementation**

Pending Commission action, staff will implement the program using the tools prepared, including online applications, guidance materials, and GIS based tools.

##### **7. Review of Transmission Main Applications**

Review transmission main applications including: prepare draft dockets, hold public hearings and provide recommendations to Commissioners

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## DRBC WATER RESOURCES PROGRAM

### Section 1.0 ENSURING THE SUSTAINABLE SUPPLY OF SUITABLE QUALITY WATER

- 1.1 Water Supply Strategy: Forecasting and Planning
- 1.2 Multi-objective Flow Management
- 1.3 Water Supply Management: Conservation, Special Area Management and Permitting
- 1.4 Determining Water Quality and Meeting Standards: Criteria-Based Programs, Anti-Degradation and Water Quality Administration

#### 1.1 WATER SUPPLY STRATEGY: FORECASTING AND PLANNING

##### 1.1.1 Water Supply Planning for a Sustainable Water Future 2060

Building on the water use and demand evaluation work in past reporting efforts (e.g., USGS/DRBC Selected Water Budgets (2005) and Estimated Groundwater Availability (2006), the US Army Corps of Engineers (ACOE) Multi-Jurisdictional Study (2008), State water supply plans, DRBC Key Sector Trend Analyses (2014)) and in partnership with USGS, the Commission will integrate efforts to prepare a detailed and comprehensive analysis of water demand, availability, and sufficiency through 2060. Past analyses, as well as recent condition reporting (see Conditions Section I of this Program) have identified areas where stress is evident and investigations will be done to identify additional areas of concern. Assessment of surface flows, aquifer conditions, anthropogenic supply needs, permitted allocations, and ecological needs will be connected to identify long-term sustainability concerns and suggest appropriate remedies. Existing models along with innovative methodologies for integrating models will be employed for the assessment and determine areas where additional storage may be needed for flow augmentation.

The work plan includes:

- Water demand projections associated with thermoelectric power generation and other energy production and exploration
- Analysis of the water audits and recommendations for future actions
- Assessment of improved current and comprehensive water use records across all sectors
- Instream flow needs for key ecological communities within the Delaware River Basin (DRB)
- Assess water availability during a repeat of the drought of the 1960's, the Basin's drought planning benchmark
- Identification of additional information and tools necessary to forecast future condition (demand, supply, climate) scenarios
- Ongoing assessment of special groundwater management areas within the Basin
- Consideration of need for groundwater withdrawal limits in areas outside of protection areas (e.g., GWPA)
- Adequacy of supply storage facilities to meet future water use and in-stream needs.

While most tasks are included in Section 1.1 of the work program, others (e.g., those related to flow modeling or agency coordination), are described in other sections of the document as appropriate.

The DRB was selected as one of three focus areas nationwide to be included in the USGS WaterSMART<sup>5</sup> (Sustain and Manage America's Resources for Tomorrow) program. Program products include:

- Acquisition, management, and integration of water-use and water-supply data
- Development of ecological-flow science including enhancement of the existing Decision Support System for parts of the Delaware River and development of a streamflow estimation tool for ungaged sites
- Development of a hydrologic watershed model (WATER) to evaluate water stressors such as growth of population centers, the effects of land-use change, water use and the effects of climate variability and climate change on water resources in the basin.

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<sup>5</sup> The WaterSMART initiative, and its component project the Water Census, are elements of Section 9508: National Water Availability and Use Assessment Program included in the Omnibus Land Management Act of 2009 (PL 111-11; <http://www.gpo.gov/fdsys/pkg/PLAW-111publ11/pdf/PLAW-111publ11.pdf>).



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The results of the USGS WaterSMART DRB focus area study will contribute significantly to the information needs of the DRBC's Sustainable Water Future planning.

### **1.1.2 Supporting State Water Supply Planning and Allocation**

DRBC works closely with the states through the DRBC Water Management Advisory Committee and by serving on committees organized by the states for water supply planning and management. This coordination and collaboration will continue. All states have stepped up data collection efforts, which are critical for well-informed planning and management. Approaches used in state planning programs, including median and low flow thresholds, infrastructure capacity, etc., will be considered as DRBC develops scenarios for Sustainable Water Future 2060.

As reflected in the updated administrative agreements between the Commission and the states of New Jersey (2015) and New York (2016), the Commission is cooperating with the state permitting/allocation programs for the groundwater and surface water withdrawals in those states. Updates to administrative agreements with Delaware and Pennsylvania are planned for FY 2017-2019. DRBC administers a special program for the Southeastern Pennsylvania Groundwater Protected Area (SEPA-GWPA, see Section 1.3.2) on behalf of the Commonwealth of Pennsylvania. New York's water supply law (see primarily ECL article 15 titles 15, 16 and 33) was amended on August 16, 2011 (Laws of New York, Chapter 401), with most of the statutory amendments effective as of February 15, 2012. The amendments expand the permit program to include withdrawals for purposes beyond public water supply, such as those for commercial, manufacturing, industrial, and other purposes, and also limit the permit program to only include systems with capacity to withdraw 100,000 gallons per day or more. Previously, permits were required for any volume of withdrawals for public supply. The revised rule indicates that since the NYSDEC, as a voting member of the DRBC, is integrally involved with the DRBC's water withdrawal approval processes, that if a water withdrawal occurs in the jurisdiction of the DRBC and the water withdrawal is approved by DRBC, as applicable, then the water withdrawal is exempt from the permit requirements of the rule. Additionally, the DRBC approval processes have provisions for including requirements from host states, which may include New York's pass-by flow requirements, as applicable, permit conditions, and regulations, including natural gas drilling regulations. With these revisions, New York's program now will be similar to that of New Jersey and Delaware. DRBC participates in Delaware and New Jersey water supply planning efforts through respective state advisory councils.

### **1.1.3 Surface Water Charging Program**

DRBC administers an ongoing Surface Water Charging Program, which includes on-line registration, reporting and invoicing, and provides resources through a Water Supply Storage Fund (WSSF). The WSSF is used to fund the cost-share debt service and joint use operations and maintenance of Blue Marsh and Beltzville reservoir, facilities where DRBC holds water supply storage. The WSSF is also used to provide the local cost-sharing support for a dozen or so USGS streamflow and water quality gages, used in flow management, water quality assessments, and for flood forecasting by the NWS.

### **1.1.4 Facility Planning**

The Commission has considerable powers of oversight relating to major facilities and projects affecting water resources in the basin, and... "for the determination of project priorities, pursuant to the requirements of the comprehensive plan and [the] water resources program."

A draft list of major projects, including reservoir enhancement options, has been assembled for evaluation against the current need for supply and regional flood mitigation. One principal need for this is to be responsive to potential future flow augmentation needs. This list will be evaluated against demand projections and storage needs as part of the Sustainable Water Future 2060 program (Section 1.1.1.). An updated list of facility needs may ultimately be incorporated into the Comprehensive Plan.

The Commission will focus on several aspects of facility planning in the next three years:

- Review of basin-wide storage capacity and ability to meet projected water use and in-stream needs.
- Coordination with the USACE on the development of the Corps Water Management System (CWMS) model and several proposed potential studies, including a study to continue work on the Delaware Estuary Hydrodynamic Model for Water Resource Management for understanding Salinity and Eutrophication and a study re-evaluating F. E. Walter Dam's services including flood control, water

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supply, water quality and recreation and existing infrastructure and operations to support the current and future demand for services. Evaluation of the macro-scale water supply sustainability for salinity repulsion using USGS-WATER and DRB-PST

**1.1.4.A Beltzville and Blue Marsh Reservoirs.** The Commission owns water supply storage in two federal reservoirs—Beltzville (Lehigh River Watershed) and Blue Marsh (Schuylkill River Watershed)—and is responsible for their annual debt service and a portion of their operation and maintenance costs. The Commission will continue to use water in these reservoirs to support the Trenton Flow Objective.

**1.1.4.B Storage Capacity Adequacy and Options.** Review of the volume and adequacy of basin-wide storage capacity is part of the Water Supply Planning for a Sustainable Water Future Section 1.1.1.

### DRBC WATER RESOURCES PROGRAM 1.1. WATER SUPPLY STRATEGY

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Sustainable Water Future	Perform modeling analysis for Sustainable Water Supply 2060 Strategy	2017	General Fund
	Evaluation of basin-wide and regional water use, projections of future needs, supply alternatives	2017-2019	
	Modeling to aid with the assessment and to determine areas where additional storage may be needed for flow augmentation	2017-2019	
	Strategies for supply sufficiency through 2060	2018	
Support of State Programs	Coordination and support of basin state water supply programs	2017-2019	General Fund
Surface Water Charging Program	Program administration, on-line registration and reporting, invoicing	2017-2019	WSSF
Facility Planning	Updated list and description of Water Supply Enhancement Options	2017-2019	General Fund
	Updated Water Supply Facilities section in the Comprehensive Plan	2017-2019	General Fund
	Coordination with the USACE in studies related to reservoir uses and management	2017-2019	General Fund/ WSSF

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### 1.2 MULTI-OBJECTIVE FLOW MANAGEMENT

The main stem of the Delaware River is the longest un-dammed river east of the Mississippi, 152 miles of which are designated under the Wild and Scenic Rivers Act. However, there are dams on several large tributaries that store water in reservoirs and regulate flow to the river through conservation releases. These facilities also provide flood mitigation, water supply, and instream flow augmentation. In addition to varying precipitation patterns, activities that affect instream flows include: releases, diversions and outflows from water supply and multipurpose reservoirs on tributaries, inter-basin water transfers from tributaries and the river, and water withdrawals from interconnected groundwater sources. Low flows may impact ecosystems and reduce the assimilative capacity of the river for wastewater discharges. High flows may cause loss of life and property, but they are also a part of natural hydrologic cycles and beneficial seasonal events for rivers. They move sediment, provide inputs of coarse particulate organic matter that feed organisms at the base of the food chain, and periodically alter the river morphology and riparian corridor, which contributes to habitat and species diversity. Seasonal high flows also provide environmental cues that trigger spawning and lifecycle events for myriad species dependent on this river (e.g., American shad, oysters, mussels, Atlantic sturgeon).

#### 1.2.1 Reservoir Operations

DRBC Staff are working with the National Weather Service (Philadelphia and Binghamton, Weather Forecast Offices; Mid-Atlantic River Forecast Center) to develop better flood warning products as well as useful forecast information of low flows for use in the determination of directed releases. For low flow predictions, NYC and the Office of the Delaware River Master are also participating.

**1.2.1.A Flexible Flow Management Program (FFMP).** On May 31, 2016, New York State, Pennsylvania, New Jersey, Delaware, and the City of New York signed a one-year agreement intended to protect fisheries habitat downstream of the New York City Delaware Basin reservoirs, enhance flood mitigation, and repel the upstream movement of salt water in the Delaware Estuary without increasing the risks to the basin's water supplies. Releases of water from the three City reservoirs (Pepacton, Cannonsville, and Neversink) located in the headwaters of the Delaware River and out-of-Basin diversions are managed according to procedures unanimously agreed to by the four states and New York City. The FFMP agreement is in effect from June 1, 2016 through May 31, 2017.

The FFMP includes operations for habitat protection and discharge (spill) mitigation. The plan makes use of New York City's Operations Support Tool (OST). The OST, a monitoring and modeling system developed by NYC Department of Environmental Protection, enables the Decree Parties (four basin states and NYC) to manage the use of water from the reservoir system and the Delaware River Basin. This tool allows prediction of reservoir-specific water storage levels, quality, and inflows, which will guide selection of releases from the three reservoirs to the Delaware River. By estimating future storage, appropriate release tables can be selected that support the fishery while limiting the risk to water supply. In addition, the program seeks to create a higher potential to achieve a 10 percent storage void in the reservoirs between September 1 and March 15, which may help reduce peak spill rates during periods of high inflows and snow melt. Once a longer term agreement is negotiated, the Water Code will be modified.

DRBC performs many water supply sustainability simulations for the Decree Parties related to the FFMP using the DRB-PST model, released in 2015. Through the development of PST, staff identified aspects of the model, which would benefit from more detailed methodologies, including the use of, and accounting for, hydropower releases, recreation releases, and emergency drought storage. Staff are currently developing and testing these methodologies.

**1.2.1.B Commission Storage (Blue Marsh and Beltzville).** During FY2016 Commission staff began reviews of the purpose, use and inclusion of Blue Marsh and Beltzville reservoirs in the Comprehensive Plan. In addition, other related Commission actions, such as dockets and resolutions, are being compiled and reviewed so that their intended use and the current status can be evaluated. The findings will be prepared for Commissioner review.

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**1.2.1.C Docket Mandated Storage.** During FY2017 Commission staff will conduct reviews for projects where the Commission has required releases from storage to make up for consumptive use. The reviews will focus on the projects' relationship to the Comprehensive Plan. Other related Commission actions, such as dockets and resolutions, will be reviewed and compiled so that their intended use and the current status can be evaluated. The findings will be prepared for Commissioner review.

### 1.2.2 Ecological Flows

Several initiatives are underway to better identify the ecological flow needs of the Basin.

**1.2.2.A Non-tidal Mainstem and Tributaries.** In April 2012, the Commission and The Nature Conservancy (TNC) began a study to develop basin-wide ecosystem flow recommendations that can be implemented within the subwatersheds of the Delaware River (Management Step 1). The study was completed in December 2013. The study area focused on all tributary rivers and streams in the Appalachian Plateau, Ridge and Valley, New England, and Piedmont Physiographic Provinces, but did not include the streams of the Coastal Plain Physiographic Province. The project also summarized information about flow-sensitive species, communities, and ecological processes for the non-tidal mainstem Delaware River as far downstream as Trenton. The resultant recommendations will be an important component in a subsequent policy development process for in-stream flow requirements (Management Step 2). Such a policy could address pass-by requirements for water withdrawals, conservation release requirements for reservoirs, consumptive use mitigation triggers, and flow targets. The recommendations may also help the Commission and other Basin partners in the planning, design (location and size), and operation of future water supply storage facilities.

A complementary project for instream flows is also part of the USGS's 3 year WaterSMART study for the Delaware River Basin. The United States Congress directed the USGS to produce a report describing the scope and magnitude of the efforts needed to provide periodic assessments of the status and trends in the availability and use of freshwater resources. As part of its Water SMART initiative (see reference in Section 1.1.1), USGS proposes to support ecological flow science in tributaries by developing a method to estimate daily mean flows for all ungaged streams in the DRB, aggregate biological data (i.e., fish and invertebrates) for the DRB, and define relations between streamflow processes and aquatic ecosystem response. To support ecological flow science for the main-stem Delaware River, USGS proposed to update and enhance an existing Decision Support System (DSS) to accurately predict flow-habitat relationships downstream of the New York City's reservoirs. The DSS would be updated and enhanced to improve accuracy of predicted flow habitat relations and increase user friendliness and transparency of calculations. In addition, additional species of interest would be added and the DSS's modeled domain would be extended to include a larger portion of the Delaware System.

**1.2.2.B Estuary.** Freshwater inflow requirements for estuary populations, such as oysters and Atlantic sturgeon spawning, are a part of ongoing research by DRBC partners. For both instream and estuary flow needs, the seasonal components affecting both flow and temperature are currently the principal elements of concern. The Trenton flow objective was set to ensure adequate fresh water flows to protect drinking water intakes in the tidal river. Predictions indicate long-term diminution of snow pack and melt as a regional effect of climate change, which may have implications for flow management alternatives to meet the flow objective. The protection of instream flow needs may require adjustments to allocation and discharge permitting criteria, particularly if flow targets are adjusted.

### 1.2.3 Flow Modeling

An understanding of water supply, storage, and flow regimes is essential for managing the water resources of the basin. DRBC continues to develop and use modeling tools to aid in the evaluation of water resources management and associated risks in the basin. In particular, the models are used to assess reservoir operations for water supply, flood mitigation, power generation and recreation, the impacts of such operations on basin resources, the ability of reservoirs to meet intended and multiple objective uses, and the effectiveness of conservation releases. DRBC worked with the USACE Philadelphia District to compare salinity (chloride) predictions from the Commission's 1-D model (DYNHYD5/TOXI5) and the Corps' 3-D model (CH3Dz) and found that the models produced comparable results. The 1-D model is currently being linked with PST and will be used to evaluate how flow objectives and reservoir operations impact salinity levels in the estuary. Salinity (specific conductivity) monitors will be added to three existing National Ocean Service (NOS) PORTS (Physical Oceanographic Real-Time System) Stations at Lewes, Cape May and

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Chesapeake City. Continuous salinity data from those three station will be used to enhance the reliability of models for the Delaware Estuary.

See also Supplemental Table B for a summary of all proposed modeling activities.

**Hydrologic Reports.** A summaries of hydrologic conditions in the basin including precipitation, streamflow, reservoir storage, groundwater levels, and the river mile location of the 7-day average 250 mg/l chloride concentration are prepared monthly, quarterly and annually. These reports are posted on the DRBC web site. In addition, flow and storage data are posted weekly on the website.

### DRBC WATER RESOURCES PROGRAM 1.2 MULTI-OBJECTIVE FLOW MANAGEMENT

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
FFMP	Analyses and Reports to support Decree Party decision-making	On-going	General Fund
DRB-PST	Improvements to DRB-PST (Planning Support Tool) including, but not limited to linkage with the 1-D salinity model, alternative FE Walter operations, and addition of Mongaup Operations	2017	General Fund
Salinity Model	Work with the USACOE, Philadelphia District to complete comparison of salinity predictions from the Commission's 1-D model (DYNHYD5/TOXI5) and the Corps' 3-D model (CH3Dz). Update as new data become available.	2017-2019	General Fund
Hydrologic Reports, Event Summaries	Report – post on web	On-going	General Fund
Evaluate Reservoir Operations	Blue Marsh, Beltzville, Power sector and Brandywine evaluations	2017-2018	General Fund
Reservoir Operations	Direct releases for Trenton as needed	2017-2019	General Fund
	Work with the NWS to develop better low flow evaluation products for better directed release calculations	2017-2019	General Fund
Instream Flow Management Step 2	Develop Pass-by flow, conservation release, consumptive use mitigation trigger policy (part of Sustainable Water Future 2060)	2017-2019	General Fund

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### **1.3 WATER SUPPLY MANAGEMENT: CONSERVATION, SPECIAL AREA MANAGEMENT AND PERMITTING**

#### **1.3.1 Water Conservation and Loss Accounting**

DRBC's water conservation program incorporates a wide range of elements, including but not limited to requirements for metering, leak detection and repair programs, water conservation plans, water conservation performance standards for plumbing fixtures, and most recently a water audit requirement to deliver staged improvements in accounting for water loss in distribution system based on the methodology proposed by the American Water Works Association (AWWA). The rule requires water suppliers to submit water audits annually. This information will inform water use analyses and improve water supply planning. Analysis of the results of this program will inform the development of performance metrics. Additional areas of investigation may include compiling information on innovative water pricing structures, which could provide an incentive for water conservation, as well as stable revenues for water purveyors, and on water reuse to provide additional tools for improving water use efficiency. Staff will review for potential implementation updated water efficiency standards developed by USEPA WaterSense standards and Energy Star for inclusion in the DRBC Water Conservation Program.

#### **1.3.2 Groundwater Management and Special Management Areas Southeast PA Groundwater Protected Area (SEPA GWPA)**

The Commission will focus analysis efforts on the subbasins of the SEPA GWPA where use assessments indicate subbasins are potentially stressed or near their withdrawal limit. The Commission will continue to monitor conditions and work with docket holders and permittees to find realistic supply solutions and to ensure that allocations support sustainability in the GWPA. The Commission also plans to enhance its tracking of groundwater level conditions and increase its use of annual hydrogeologic reports submitted by docket/permit holders. This information and program status report will be used to provide a more comprehensive analysis of groundwater level conditions across the GWPA.

#### **1.3.3 Dockets and Permitting**

DRBC's regulatory activities remain important for water supply management and planning. In order to eliminate unnecessary redundancy and to streamline project reviews, updated administrative agreements between the Commission and the states of New Jersey and Delaware were executed in December 2009 (NJ) and July 2010 (DE), with minor amendments made to both in May 2013. On March 11, 2015 the Commission adopted Resolution No 2015-4 directing the Executive Director to initiate rulemaking to amend the Commission's Rules of Practice and Procedure to establish the One Permit Program (Rule). The Commission published a draft rule in May 2015 and held a public hearing in June 2015. The Commission approved the Rule in December 2015. The Resolution also authorized the Executive Director to enter into an administrative agreement with the NJDEP. In March 2015 an Administrative Agreement (AA) between DRBC and NJDEP was executed. Upon approval of the One Permit Program Rule, the One Permit Program portion of the AA was activated. In March 2016 an Administrative Agreement (AA) between DRBC and NYDEC was executed. The Commission expects to execute similar agreements with the Commonwealth of Pennsylvania and the State of Delaware in the next few years. DRBC will continue to support state partners in their permitting programs through data collection, assessment, and planning, and will issue water supply dockets in accordance with Administrative Agreements and special area management programs. The DRBC database will be updated to incorporate state permit conditions.

#### **1.3.4 Compliance**

Staff will continue annual reviews of DRBC-required data submission, such as the Water Audit Reports. Pre-emptive correspondence and notification systems will continue for docket expiration dates and data/report submittal date reminders.

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### DRBC WATER RESOURCES PROGRAM 1.3 WATER SUPPLY MANAGEMENT

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Water Conservation and Loss Accounting	Assess data inputs from Water Audit submissions	Ongoing	General Fund
	Develop performance metrics for water loss accounting	2018-2019	
	Develop updated water efficiency standards using USEPA WaterSense standards and/or Energy Star Certification	2017-2019	General Fund
Southeastern PA Groundwater Protected Area	Evaluation of water use in subbasins of SEPA GWPA against allocation and supply limits	Ongoing	PA SEPA GWPA
	Preparation of GWPA Status Report	2018	
Water Supply Dockets	Review and processing of water supply dockets in accordance with AAs	Ongoing	Project Review Fees
	Update DRBC database to incorporate state allocation permit conditions	Ongoing	General Fund
Compliance	Track construction start/completion forms, monitoring requirements, docket expirations	Ongoing	General Fund

### 1.4 DETERMINING WATER QUALITY AND MEETING STANDARDS: CRITERIA-BASED PROGRAMS, ANTI-DEGRADATION AND WATER QUALITY ADMINISTRATION

Note: Details on Aquatic Life, including ecosystem needs and restoration, are in Section 2.3.

#### 1.4.1 Special Protection Waters

The Delaware River Basin is unique in having many miles of high quality waterways in the midst of the densely populated Mid-Atlantic metropolitan area. It provides an enormous benefit to the citizens and workers of the Basin and presents a management challenge to maintain existing water quality in a region of substantial population change. The Commission will continue to work with the states and federal agencies, including the National Park Service (NPS), in the implementation of the Special Protection Waters (SPW) program to maintain no measurable change to existing water quality (EWQ) in the non-tidal river. Implementation includes management through the DRBC dockets and state NPDES permits, including coordination of programs, and monitoring programs to obtain data to assess any changes to EWQ.

Commission staff recently completed a report evaluating monitoring data to assess measurable changes to EWQ in the Lower Delaware River, and also prepared an atlas of Existing Water Quality data for the Upper and Middle Delaware River and its tributaries. The EWQ targets are statistically-defined numeric targets for selected water quality constituents principally nutrients and conventional parameters. These site-specific water quality targets will improve the ability of DRBC and the states to implement Special Protection Waters permit review and assessment of measurable change. The targets will be considered in updating Special Protection Waters rules and guidance for these two sections of the river.

Based upon these three major advancements achieved in the Special Protection Waters program (see section 1.C) additional activities and/or work products are planned for FY 2017-2019:

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- Initiation of the second Lower Delaware Measurable Change Assessment 2019-2021;
- Site-specific EWQ targets for all mainstem and tributary control points in the Upper and Middle sites (with a few additional Lower Delaware sites) (see the Existing Water Quality Atlas of the Delaware River Special Protection Waters (DRBC 2016); and

Over the next three years, the following tasks are scheduled to continue and capitalize upon the advancements listed above:

- Plan and begin execution of the next assessment of measurable changes to existing water quality 2019-2021. This is expected to cover about 50 of the 85 Delaware River and tributary control points in the entire Special Protection Waters region.
- Periodic updates of the EWQ Atlas as new information become available.
- Proposed updates of water quality regulations as needed.
- Publication of SPW outreach and educational materials, including interactive maps, web applications to view and retrieve SPW data; improved operating procedures for monitoring and assessment of the SPW region; and guidance for implementation of SPW rules.

### 1.4.2 Criteria Based Program

DRBC's criteria based program will continue to focus efforts on the assessment of water quality and support of project review. While traditional physical/chemical approaches will continue, increasing emphasis will be placed on establishing methodologies for assessing ecosystem health appropriate for the large river system. Specific species of concern will be addressed through other programs and activities.

#### 1.4.2.A Monitoring Programs to Assess Criteria

**1.4.2.A.1 Long Term Boat Run Monitoring.** The long term estuary monitoring program conducted by the Commission (Boat Run Survey) currently includes 7 sampling events at 22 stations in the tidal river and bay. This program will be extended in 2017 to a year-round effort resulting in 12 sampling events at 22 stations. This program provides data to assess compliance with Commission water quality criteria and also provides data on nutrient concentrations and potential effects. DRBC continues to employ rotational monitoring to ensure that all criteria are periodically assessed.

**1.4.2.A.2 Dissolved Oxygen Criteria Updates.** Although the worst of the dissolved oxygen problems have been addressed over the past 50 years, dissolved oxygen conditions remain a concern even today. While current conditions typically meet the 1967 dissolved oxygen criteria, mid-summer dissolved oxygen is, at times, only 50% or less of full saturation levels in the areas around the Ben Franklin Bridge. At these depressed oxygen levels, studies have shown that significant mortality can occur for juvenile fishes native to the Delaware Estuary (e.g., Atlantic sturgeon).

DRBC will continue working with co-regulators and the Water Quality Advisory Committee to define the highest attainable aquatic life use and supporting Dissolved Oxygen criteria in estuary Zones 3 to 5.

**1.4.2.A.3 Nutrient Criteria Development.** The Delaware Estuary has both high loadings and high concentrations of nutrients relative to other estuaries in the United States. The effects from these high nutrients are not well-understood, but monitoring in the estuary shows signs of poor ecological health, including a persistent summer dissolved oxygen sag in the urban corridor of the estuary. The Delaware River Basin Commission serves as the lead agency for developing nutrient and/or nutrient-related criteria for the Delaware Estuary.

DRBC continues close coordination with State, Federal, and other stakeholders through its Water Quality Advisory Committee on issues related to establishing nutrient criteria including the identification of appropriate ecological endpoints.

DRBC has invigorated its efforts to develop an Estuary Eutrophication Model with resources obtained through a grant under the Delaware Watershed Research Fund. Completion and calibration of this model



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will ultimately allow assessment of the attainability of wasteload allocations that will support the adoption of revised designated uses and associated dissolved oxygen criteria, and nutrient criteria, if needed.

**1.4.2.A.4 Polychlorinated Biphenyls (PCBs).** A polychlorinated biphenyl (PCB) is any of the 209 configurations of this organochloride molecules with 1 to 10 chlorine atoms attached to two phenyl rings. PCBs were widely used as dielectric and coolant fluids, for example in transformers, capacitors, and electric motors. Based on evidence that PCBs are persistent in the environment and can cause numerous health effects in the immune, reproductive, nervous, and endocrine systems of animals and humans, their manufacture and distribution were banned, but their use continues. Managing PCBs in the Basin is a major DRBC program. The Commission coordinates its activities to monitor and manage PCBs with the States of New Jersey, Delaware, Pennsylvania, and EPA Regions II and III, especially for incorporating PCB monitoring and Pollutant Minimization Plan (PMP) development in NPDES permits. Currently, approximately 94 dischargers are monitoring and/or implementing PMPs. All PCB analyses beginning in 2005 are being undertaken utilizing EPA Method 1668A for all 209 PCB congeners. The benefits of using Method 1668A is a better characterization of effluent, comparability of results between dischargers, reduced analytical uncertainty, and better long-term trend analysis. Dischargers continue their submission of monitoring information to DRBC where it is housed in an Access database specifically developed for PCB data. This monitoring information is utilized in evaluating the temporal and spatial trends of PCB loadings and the effectiveness of Pollutant Minimization Plan (PMPs) in reducing PCBs. A summarization of loading has been performed and results have been presented to the Commissioners and at a PMP Workshop. The presentation is posted on the Commission's web site at: [http://www.nj.gov/drbc/library/documents/PMPWorkshop-Oct2012/cavallo\\_pres102212.pdf](http://www.nj.gov/drbc/library/documents/PMPWorkshop-Oct2012/cavallo_pres102212.pdf).

The Commission will continue the implementation of the Stage 1 and Stage 2 PCB TMDLs, including:

- Ongoing point source data review and assessment
- Evaluation of Pollutant Minimization Plans (PMPs)
- Implementation of the Action Levels requirement of the Stage 2 TMDLs in NPDES permits
- Support to U.S. EPA Regions II and III as they establish Stage 2 TMDLs for Zones 2 – 6, and assistance to EPA/states in the implementation the TMDLs.

Ambient water samples were collected in summer of 2015 at 22 stations in Zones 2-6 for analyses of PCBs, dioxin/furans, pesticides, and PFCs. Fish tissue samples were also collected at 8 locations in the estuary and non-tidal river in 2015. Sediments and fish samples from Delaware Bay were collected in 2016 for a similar suites of chemicals. Collected information in multi-media will be assessed and compared with previously collected data to identify trends and assess the impact of PCB load reductions already achieved.

**1.4.2.A.6 Metals.** DRBC will be studying areas of elevated concentrations of metals and evidence of criteria exceedances. In addition, the Commission will be focusing attention on the following:

- **Copper.** Copper (Cu) is a naturally occurring trace element found in surface waters and, while essential to virtually all plants and animals, it can be toxic to aquatic life even in low concentrations. Due to sporadic exceedances in Zones 5 and 6, DRBC continues to monitor and assess, and with the acquisition of more sensitive analytical equipment by the State of Delaware will be monitoring at lower levels for a more comprehensive assessment.
- **Methylmercury.** Methylmercury (Me-Hg) is known to cause developmental impairments in children in utero and suspected of causing disruptions in the reproductive cycle of some aquatic life. Predominantly sourced from the burning of inorganic wastes and fossil fuels, it has an affinity for chloride, nitrate, and certain proteins and therefore is readily biomagnified in the aquatic food chain. To investigate exceedances of methylmercury in fish tissue residue in Zones 5 and 6, DRBC is continuing the collection and analysis of fish tissue samples including analysis of Me-Hg concentrations. DRBC is coordinating with the States and EPA through the TAC and MAC.

**1.4.2.A.7 Chronic Toxicity.** Chronic toxicity is caused by repeated or long-term exposure to low doses of a toxic substance. In 2000, the Commission determined that the assimilative capacity of Zones 2-5 for chronic toxicity had been exceeded. Based on the chronic toxicity studies of ambient river water from the tidal Delaware River undertaken by the DRBC in 2000 and 2001, Zone 5 is currently listed as a Category 3 water for chronic toxicity (insufficient or no data and information to determine if any designated use is attained). FY 2017 work focused data collection in selected tributaries to the estuary to provide additional

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data to help address ambient water toxicity issues. The specific objectives of these studies are to assess if toxicity is present in water samples as measured by laboratory controlled methods for short-term chronic toxicity.

**1.4.2.B Contaminants of Emerging Concern.** From a multi-year survey (2007, 2008, and 2009) of emerging contaminants of concern in ambient water of the tidal Delaware River, the DRBC identified a prioritized list of pharmaceuticals and personal care products (PPCPs), as well as perfluoroalkyl and polyfluoroalkyl substances (PFASs) and polybrominated diphenyl ethers (PBDEs), for further evaluation of sources, fate, and effects in water column, sediments, and biota: (<http://www.state.nj.us/drbc/library/documents/contaminants-of-emerging-concernAug2013rev.pdf>).

**1.4.2.B.1 Dioxins and Furans.** Dioxins/furans, by-products of industrial processes, are commonly regarded as toxic and persistent organic pollutants (POPs). Dioxins/furans are contaminants of concern contributing to fish advisories in the Delaware Estuary. There are 75 different dioxins and 135 different furans. DRBC has adopted water quality criteria for the most toxic compound: 2,3,7,8-TCDD. Dioxin/furan concentrations in fish tissue are currently being addressed through fish consumption advisories and other environmental management approaches in the Delaware Estuary. DRBC is coordinating with states and other agencies through the Toxic Advisory Committee (TAC) to assess these contaminants through the use of Toxic Equivalency Factors which relate the individual dioxins and furans to 2,3,7,8 – TCDD. This involves periodic monitoring for these contaminants in fish tissue and sediments.

### 1.4.3 Water Quality Modeling

In the non-tidal river, model development will also continue with the ongoing calibration and validation of QUAL2K models for the Lower Delaware, Lehigh River, Neversink River, Brodhead Creek and smaller tributaries throughout FY 2017 to 2019. All models will be continually refined, recalibrated, or validated as more effluent data or ambient data are available. Utilization of updated models in no measurable change evaluations will reduce uncertainties.

In the estuary, a 1-D eutrophication model will be developed and linked with the existing 1-D DYNHYD5 hydrodynamic model to be used as a screening level model prior to the development of a sophisticated 3-D model. Based on findings from the 1-D modeling effort, a 3-D hydrodynamic model and eutrophication models will be developed to support the Commission's assessment of the designated use and associated water quality criteria for dissolved oxygen, and for other elements of the Commission's Nutrient Criteria Strategy. In collaboration with USACE, a project comparing the Corps' 3-D hydrodynamic model is being completed evaluating salinity levels during two periods, including the drought of record. These models could be used to link reservoir operations to the salt front, apart from the nutrient issues. See Section 1.2.3. Flow Modeling for a fuller explanation and Supplemental Table B for a summary of ongoing and proposed modeling activities.

Near field modeling efforts to support issuing DRBC dockets or NPDES permits for an acute mixing zone, heat dissipation area, and/or TDS mixing zone will be continued for FY 2017 – 2019.

### 1.4.4 Water Quality Dockets and Permitting

DRBC's regulatory activities remain important for water quality management. In order to eliminate unnecessary redundancy and to streamline project reviews, updated administrative agreements between the Commission and the states of New Jersey and Delaware were executed in December 2009 (NJ) and July 2010 (DE), with minor amendments made to both in May 2013. On March 11, 2015 the Commission adopted Resolution No 2015-4 directing the Executive Director to initiate rulemaking to amend the Commission's Rules of Practice and Procedure to establish the One Permit Program (Rule). The Commission published a draft rule in May 2015 and held a public hearing in June 2015. The Commission approved the Rule in December 2015. The Resolution also authorized the Executive Director to enter into an administrative agreement with the NJDEP to demonstrate the One Permit Program and inform the rule making. In March 2015 an Administrative Agreement (AA) between DRBC and NJDEP was entered into and the Demonstration Project initiated in accordance with the Resolution and AA. Upon approval of the One Permit Program Rule, the One Permit Program portion of the AA was activated. In March 2016 an Administrative Agreement (AA) between DRBC and NYDEC was executed. The Commission expects to execute similar agreements with the Commonwealth of Pennsylvania and the State of Delaware in the next few years. DRBC will continue to support state partners in their permitting programs through data collection,

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assessment, mixing zone analyses, no measurable change evaluations, and other modeling and will issue water quality dockets in accordance with Administrative Agreements and special area management programs, with continued emphasis on cooperative efforts to implement DRBC standards in shared waters. The DRBC database will be updated to incorporate state permit conditions.

### 1.4.5 Water Quality Assessment Report

DRBC biennially reports on the conditions of main stem river water quality relative to criteria in accordance with EPA guidelines for 305 (b) reporting. Results of the 2016 report are described in Section 1.C. The next report is due in April 2018.

### 1.4.6 Compliance

Staff will continue annual reviews of DRBC-required data submission, such as the annual effluent monitoring reports (AEMRs). Pre-emptive correspondence and notification systems will be continued for docket expiration dates and data/report submittal date reminders.

### DRBC WATER RESOURCES PROGRAM 1.4 DETERMINING WATER QUALITY AND MEETING STANDARDS: CRITERIA-BASED PROGRAMS, ANTI-DEGRADATION, WATER QUALITY ADMINISTRATION

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Water Quality Standards	Update water quality policy and standards for ammonia and temperature	2017-2018	General Fund
	Update designated uses for aquatic life in the estuary to reflect the highest attainable uses.	2017-2022	General Fund, Delaware Watershed Research Fund Grant
Scenic Rivers Monitoring Program	Initiate intensive monitoring for EWQ assessment	2019-2021	EPA §106, NPS
Lower Delaware River and Tributaries Model	Model refinement, calibration, and validation	Ongoing	General Fund
Brodhead Creek Model	Model refinement, calibration, and validation	Ongoing	General Fund
Neversink River Model	Model refinement, calibration, and validation	Ongoing	General Fund,
Lehigh River Model	Model refinement and validation	Ongoing	General Fund,
Boat Run Survey	Perform rotating monitoring plan to ensure periodic assessment of all parameters (criteria)	Ongoing	EPA §106
	Data in WQX	Ongoing	EPA §106
	5-year report on conditions	2017	EPA §106
Estuary Nutrients	Ambient monitoring for nutrient parameters	Ongoing	EPA §106

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Program/Project	Products/Outputs	Fiscal Year	Funding Sources
	Report analyzing point source monitoring data	2017	EPA §106
Chronic Toxicity	Ambient surveys and trend analysis of effluent data	2017-2019	EPA §106
PCBs	Evaluate PMPs and point source monitoring data	Ongoing	EPA §106
	Support EPA in establishing Stage 2 TMDLs	2017	General Fund
	Continue implementation of Stage 2 TMDLs	2018 - 2019	General Fund, EPA §106
Toxics (Ammonia and emerging contaminants)	Coordination with TAC; recommended criteria revision	2017-2019	General Fund, EPA §106
Water Quality Dockets	Changes to Water Quality regulation and Rules of Practice and Procedure as required	2017-2019	General Fund
	Review and processing of water quality dockets per AAs	Ongoing	Project Review Fees
Water Quality Assessment Report	Prepare assessment for EPA and states	2018	EPA 106 Grant/General Fund
Compliance	Construction start/completion forms, monitoring requirements, annual effluent monitoring reports, docket expirations	Ongoing	General Fund
Eutrophication Model for Delaware Estuary	Development of screening level 1-D eutrophication model	2017	EPA §106, Delaware Watershed Research Fund Grant, PA CZM, General Fund
	Selection and development of a state of the art 3-D hydrodynamic and eutrophication model. Data collection for model calibration.	2018	
	Model calibration and validation for CBOD reallocation, potentially NBOD and/or ammonia allocations, and other nutrient parameters.	2019-2020	

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### **Section 2.0 WATERWAY CORRIDOR MANAGEMENT**

- 2.1 Flood Warning and Loss Reduction
- 2.2 Enhanced Recreation
- 2.3 Aquatic Life and Wildlife Habitat Improvement

#### **2.1 FLOOD WARNING AND LOSS REDUCTION**

Flood loss reduction is a shared responsibility among federal, state, and local agencies and organizations in the Delaware River Basin. DRBC's activities involve coordination, education, planning and permitting. DRBC's Flood Advisory Committee (FAC) brings together government and non-governmental stakeholders across jurisdictional boundaries and facilitates coordination among agencies to improve the basin's flood warning system and mitigate flood losses. DRBC will assist with and, as appropriate, coordinate efforts to improve planning to reduce flood losses.

##### **2.1.1 Flood Mitigation Task Force Recommendations**

As the result of pervasive flooding in 2004-2006, DRBC commissioners convened a Delaware River Basin Interstate Flood Mitigation Task Force. This Task Force produced an Action Agenda consisting of consensus-based recommendations in six priority management areas—flood warning, floodplain mapping, floodplain regulation, stormwater management, structural and non-structural mitigation, and reservoir operations—all focused on a more proactive and systematic approach to flood mitigation within the Delaware River Basin. Many of the priority recommendations have been completed in collaboration with NOAA/NWS, USGS, USACE, the Nurture Nature Center (NNC), and the DRBC Flood Advisory Committee. As funding becomes available, DRBC will continue to identify opportunities for collaborative implementation of the Task Force recommendations and track progress. DRBC staff will work with the FAC to update the "Completed and Ongoing Flood Studies and Projects in the Delaware River Basin" spreadsheet (working draft last updated September 2015).

##### **2.1.2 Flood Warning and Preparedness**

DRBC serves on the Mid-Atlantic River Forecast Center Customer Advisory Board, working to improve NWS products related to flood forecasting and warnings in the DRB and nationwide. As a continuation of previous Education and Outreach Efforts, DRBC has created a flood resources portal which makes the information more accessible and focus on flood warning products, preparedness and DRB flood issues.

##### **2.1.3 Flood Mitigation**

DRBC will be actively engaged with the federal entities to monitor the development of robust scientific information to support flood mitigation for the Basin. Up-to-date and regionally relevant information on changes in expected precipitation patterns, climate, and land use patterns, for example, could have a significant impact on how to prepare for storm events and manage floodplains.

Beyond planning and preparedness, reservoir operating plans and structural changes present opportunities for flood mitigation. As funding allows, DRBC will evaluate potential reservoir management options that may provide additional protection from flood damage, specifically via the development of flood mitigation plans outlining potential operational adjustments for the larger reservoirs in the basin.

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### DRBC WATER RESOURCES PROGRAM 2.1 FLOOD WARNING AND LOSS REDUCTION

Program/Projects	Products/Outputs	Fiscal Year	Funding Sources
Interstate Flood Mitigation Task Force Recommendations	Identification of opportunities for implementation and tracking implementation of recommendations	2017-2019	General Fund, Agency In-Kind
Flood Warning Products and Messages	Collaborate with MARFC and NWS for improvements and expansion of flood warning products for the DRB	2017-2019	General Fund
Flood plain dockets	Review and processing of flood plain dockets	Ongoing	Project Review Fees

### 2.2 ENHANCED RECREATION

Commission staff takes part in several efforts to enhance recreational opportunities in the basin. DRBC is one of many stakeholders involved in the effort to designate the tidal Delaware River a National Recreation Area; other key partners include the Pennsylvania Environmental Council and the Partnership for the Delaware Estuary. DRBC is also a member of the Urban Waters Federal Partnership, which helps coordinate and focus federal resources on the urban waters of Philadelphia, Camden, Chester, and Wilmington, and includes numerous local and regional partners. DRBC staff also participates on the steering committee for the Delaware River Sojourn, which plans an annual paddling trip on the river focused on promoting river recreation and environmental stewardship.

DRBC will review plans for enhanced fisheries protection from Beltzville Reservoir when a proposal is developed by the Pennsylvania Fish and Boat Commission (PAFBC). There is a proposed potential USACE study that would re-evaluate F. E. Walter Dam's services including flood control, water supply, water quality and recreation and existing infrastructure and operations to support the current and future demand for services. DRBC will work with the USACE in scoping, coordinating and evaluating the impacts of the potential options.

### 2.3 AQUATIC LIFE AND WILDLIFE HABITAT IMPROVEMENT

#### 2.3.1 Ecosystem Needs

DRBC intends to remain involved in the development and expansion of creative funding opportunities, such as the Delaware River Basin Conservation Act, currently under Congressional consideration for authorization and \$ 5,000,000 in funding. DRBC will continue to increase the understanding of ecosystem needs and habitat conditions in the basin through ambient water quality monitoring, fluvial geomorphologic assessments, and macroinvertebrate and periphyton surveys conducted in partnership with federal and state agencies. Commission staff continues to monitor macroinvertebrates, algae and habitat of the non-tidal Delaware River, working to improve DRBC's existing macroinvertebrate Index of Biological Integrity (IBI) for assessing the aquatic life use of the Delaware River. Although there are still insufficient data for development of an algal index for aquatic life use assessment, there exists sufficient information to evaluate general algal conditions in support of aquatic life use attainment decisions. The Biological Advisory Subcommittee to the WQAC will be reconvened as needed to consider the results of the IBI improvements. See also Section 1.2.2. for Ecological Flows.

#### 2.3.2 Ecosystem Restoration

PPL Martins Creek NRDA: The Commission has agreed to function as the recipient and distributor of certain funds required to be expended as a result of the damages resulting from the 2005 Ash Slurry Spill from the PPL Martins Creek facility, located in Lower Mount Bethel Township, Northampton County, Pennsylvania. The Natural Resource Damage Assessment (NRDA) was developed for the spill by PADEP in consultation with the NJDEP, PA Fish and Boat Commission, and the DRBC. With the settlement agreement ratified in 2016, the Commission will manage the funds for restoration projects located entirely within Pennsylvania

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and those defined as “mussel restoration projects,” which may be located in Pennsylvania and/or New Jersey. The Pennsylvania restoration projects consist of dam removals on the Bushkill Creek and the Little Lehigh River. The Commission will enter into grant agreements with local watershed organizations, which are expected to assume lead roles in removal of the identified dams located within Pennsylvania. The watershed organizations are expected to be responsible for all design, permitting, and administrative and construction costs. DRBC staff will supervise performance under the grant agreements to ensure that the deliverables are carried out in a timely manner that is consistent with the Settlement terms.

DRBC is monitoring the Paulins Kill in support of the Columbia Dam removal project. Monitoring activities include technical support of TNC staff for sediment evaluation and geomorphology assessment; installation of continuous monitoring devices upstream and downstream of the project area; and year-round water quality monitoring before, during and after the dam removal to assess water quality effects.

### 2.3.3 Regional Sediment Management

The USACE and USEPA have led a group of agencies in the development of a Regional Sediment Management (RSM) Plan as recommended in the *Water Resources Plan for the Delaware River Basin 2004* (Basin Plan, Objective 2.3.F.) Two Teams have been created: the RSM Workgroup Implementation Team will work with agencies and other entities to oversee the beneficial re-use of dredged material; the Regional Dredging Team (RDT) will work to address water quality issues during the dredging process and at dredged material placement sites. DRBC staff will continue participation in both teams.

## DRBC WATER RESOURCES PROGRAM

### 2.3 AQUATIC LIFE AND WILDLIFE HABITAT IMPROVEMENT

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Ecosystem Needs	Review data and create an Index of Biological Integrity	2017-2019	General Fund
Ecosystem Restoration	Manage distribution of funds for PPL Martins Creek NRDA projects	2017-2019	PPL NRDA settlement via PADEP
Regional Sediment Management	Participation in RSM Implementation and Regional Dredging Teams	2017-2019	General Fund

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### Section 3.0 LINKING LAND AND WATER RESOURCE MANAGEMENT

- 3.1 Integrated Resource Management and Watershed Partnerships
- 3.2 High Value Water Resource Landscapes

#### 3.1 INTEGRATED RESOURCE MANAGEMENT AND WATERSHED PARTNERSHIPS

##### 3.1.1 Watershed Management Partnerships

DRBC watershed management efforts include watersheds that involve two or more states as well as projects within a single basin state, typically as pilot programs for larger multi-jurisdictional management efforts. Staff is involved with collaborative partnerships in these watersheds:

- **Christina Watershed.** DRBC is a founding member of the Christina Basin Clean Water Partnership, which was established in the 1990s to improve source water quality in the 300-sq. mi. interstate watershed. DRBC participates in activities and provides support as the Partnership continues implementation of its long term clean water strategy.
- **Schuylkill River Watershed.** DRBC is a founding member of the Schuylkill Action Network (SAN), a collaboration among federal, state, and regional agencies for local implementation of source water protection projects. DRBC serves on the Executive Steering and Planning Committees to oversee Work Groups that prepare and execute projects to improve the management of stormwater, agricultural activities, wastewater discharges, and mining reclamation. In addition, a portion of the Schuylkill River Restoration Fund (see below) is directed to projects identified through SAN as priority source water protection projects.
- **Common Waters.** DRBC is a member of the Common Waters collaborative, which is led by the Pinchot Institute and dedicated to protection of the headwaters of the Delaware River Basin, a drinking water source for millions of users.
- **Coalition for the DRB Watershed.** This is a coalition of non-governmental organizations created to achieve greater national recognition and funding for the basin. DRBC's involvement is limited to general assistance and participation in the annual workshop.
- **Delaware River Watershed Initiative.** This initiative has brought significant financial resources to bear in eight geographic areas in the basin through the support of the William Penn Foundation. DRBC is involved in committees that provide oversight for assembling plans from across the basin (Blue Print Work Group) and mapping and modeling future growth (DRB Land Use Dynamics) led by Shippensburg University.

##### 3.1.2 Watershed Restoration

The Schuylkill River Restoration Fund, a unique public/private partnership, provides grants to government agencies and non-profit organizations for projects that improve the quality of water in the watershed. The grants focus on three major sources of pollution: stormwater run-off, agricultural pollution, and abandoned mine drainage. DRBC participates in the steering committee that reviews proposals, selects projects for funding, and oversees program direction and expansion. The Executive Director is responsible for approving the distribution of Exelon Generation LLC's contributions to the SRRF.

##### 3.1.3 Delaware Valley Early Warning System

The Delaware Valley Early Warning System is an integrated monitoring, communication, and notification system used to provide advanced warning of water quality events to water suppliers and industrial intake operators in the Schuylkill and Delaware River watersheds. The EWS was initially deployed in 2004 and by 2008 had grown to include over 250 users in 47 different organizations within the EWS coverage area. The Commission is one of many EWS partners, which include 23 water treatment plants (WTPs) from 12 utilities in Pennsylvania and 5 WTPs from 5 utilities in New Jersey, along with PA DEP, NJ DEP, US EPA, USGS, US Coast Guard, County Health Departments, and over 25 industries. The EWS provides advanced warning of water quality events, web-based tools for determining proper event response, and a strong partnership between water users and emergency responders in the Schuylkill and Delaware River



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watersheds. The Commission currently serves as the “banker” for handling the annual administrative/user fees.

### 3.2 HIGH VALUE WATER RESOURCE LANDSCAPES

DRBC promotes sound practices of watershed management in the Basin (Compact §7.1). The Basin Plan goals regarding watershed management include:

- Preserving and restoring natural hydrologic cycles through improved stormwater management
- Maintaining and restoring the function of High Value Water Resource Landscapes
- The integration of water resource considerations into land use planning and growth management

The protection of water resources is indicative of all DRBC programs, regulations, and permit conditions. Mapping tools being developed include GIS mapping of High Value Water Resource Landscapes and a template for assessing these landscapes. The mapping is expected to be used by local agencies as a screening tool for managing development while protecting landscapes critical to the flow and quality of basin waters.

DRBC participates in setting water research priorities and evaluating proposals submitted to the NJ Water Resources Research Institute (NJWRI) for project funding through USGS.

## DRBC WATER RESOURCES PROGRAM

### 3.0 LINKING LAND AND WATER RESOURCE MANAGEMENT

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Christina Clean Water Partnership	Continued participation to meet Long Term goal of restoring the water quality of all watershed streams to designated uses	Ongoing	General Fund
Delaware River Watershed Initiative	Participation in steering committees and workgroups	Ongoing	General Fund
Coalition for the DRB	General assistance and participation in the annual workshop	Ongoing	General Fund
Schuylkill Action Network	Collaborative facilitation and oversight of watershed improvement projects for source water protection	Ongoing	General Fund
Common Waters	Collaborative led by the Pinchot Institute dedicated to protection of the headwaters of the Delaware River Basin	Ongoing	General Fund
Watershed Restoration: Schuylkill River Restoration Fund	Annual review and recommendations of projects for funding	Ongoing	General Fund
High Value Water Resource Landscapes	Mapping and availability of information on HVWRLs to support decision making and water resource protection	2017	William Penn Foundation

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### Section 4.0 INSTITUTIONAL COORDINATION and COOPERATION

- 4.1 Intergovernmental Coordination
- 4.2 Data Sharing and Management
- 4.3 Agency Funding
- 4.4 Associations and Internal Advisory Committees
- 4.5 Utilizing Planning and Regulatory Authority

#### 4.1 INTERGOVERNMENTAL COORDINATION

##### 4.1.1 Federal and Interagency Collaborative Partnerships.

It is important that the activities and authorities of the Commission and of the multiple federal, state, and local governmental agency efforts to manage the water resources of the basin are conducted in a coordinated and supportive fashion. Collaboration among state and interstate agencies across basin boundaries encourages the exchange of information, ideas, and experience and supports initiatives of benefit to member agencies and to water resources management generally. The Commission is involved in several federal/state initiatives that not only stimulate positive environmental outcomes in the basin, but also help shape water policy on regional and national scales. Other activities are focused on improving coordination and collaboration generally among federal and state agencies with authorities within the Basin, as well as with regional entities. This includes many ongoing as well as special initiatives.

- **Federal Summit.** The Army Corps is the lead agency for a biennial summit of federal agencies. DRBC will assist the Army Corps as needed for the planning of the Federal Summit.
- **Delaware Estuary Program.** Participation in multiple committees (Steering, Estuary Implementation, Science and Technical Advisory), as well as special projects (State of the Estuary) and events (biennial Science Conference). DRBC is assisting with the update of the Comprehensive Conservation Management Plan (CCMP) for the Delaware Estuary. DRBC will assist in the development of the next State of the Estuary/Basin report.
- **Upper Delaware Council.** DRBC is a non-voting member the Council which encourages collaboration among municipalities in the Upper Delaware Scenic River corridor and reviews actions for conformity with the area-wide Management Plan.
- **Fish and Wildlife Management Cooperative (Delaware River Basin).** DRBC participates as a non-voting liaison to this Cooperative, which deals primarily with fishery management issues. DRBC also assists the Cooperative with field work as well as giving guidance on Basin issues and initiatives.
- **Scenic Rivers Monitoring Program (SRMP).** This long-standing comprehensive water quality monitoring program is a collaborative partnership between the DRBC and National Park Service (NPS) on the Upper and Middle Delaware designations.
- **Lower Delaware Wild and Scenic Partnership River.** DRBC is a management committee member for implementation for the Lower Delaware Wild and Scenic Management Plan. DRBC has a collaborative relationship with NPS. DRBC conducts water quality monitoring and assessment in support of the Lower Delaware.
- **Delaware River Source Water Collaborative.** DRBC has been a partner in the Collaborative since 2010. DRBC will continue to work alongside USEPA and the basin states to further source water protection for the Basin.
- **Office of the Delaware River Master.** DRBC coordinates with the Office of the Delaware River Master on flow related issues and negotiations regarding the Decree Parties.

##### 4.1.2 State-DRBC Coordination.

Actions and activities to improve coordination with agencies of the basin states include:

- **Update DRBC-State Administrative Agreements.** On March 11, 2015 the Commission adopted Resolution No 2015-4 directing the Executive Director to initiate rulemaking to amend the Commission's Rules of Practice and Procedure to establish the One Permit Program (Rule). The Commission published a draft Rule in May 2015 and held a public hearing in June 2015. The Commission approved the Rule in December 2015. The Resolution also authorized the Executive Director to enter into an administrative agreement with the NJDEP to demonstrate the One Permit Program and inform the rule making. In March 2015 an Administrative Agreement (AA) between DRBC and NJDEP was entered into and the Demonstration Project initiated in accordance with the Resolution and AA. The Commission

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expects to execute similar agreements with the Commonwealth of Pennsylvania and the State of Delaware.

- **State Advisory Committees.** DRBC participates in the New Jersey Water Supply Advisory Council, NJDEP Water Monitoring Council, and serves as a legislated member of the New Jersey Clean Water Council and the Delaware Water Supply Coordinating Council. DRBC serves on the Drought Management Task Force for Pennsylvania and the Water Supply Coordinating Council for Delaware.
- **New Jersey Water Resources Research Institute (NJWRRI).** DRBC is a member of the steering committee for the Institute in New Jersey at Rutgers University. Each state has a WRRI through which USGS provides funds to support research in water resource issues.

### 4.2 DATA SHARING AND MANAGEMENT

Maintaining a Geographic Information System (GIS), along with gathering, processing, and mapping new data, is crucial for water resource management programs and projects within and external to DRBC. Staff will add interactive maps to the DRBC web site to allow for improved public access to information and water resources data. Maintaining the Commission's Integrated Database, which includes water charging, water use, communications, and project review information, is also vital to implementing core Commission programs. Staff will continue efforts to assimilate data from the four basin states and maintain datasets to support analysis at the basin scale. The Commission's library and central files contain hard copies of the Commission's dockets and applicant information, vital to day-to-day operations and serves as the mechanism to capture and log official Commission actions.

### 4.3 AGENCY FUNDING

The Basin Plan acknowledges the necessity of securing adequate resources to support water resource management, as well as the challenge of doing so. DRBC management works to secure funding for ongoing agency support as well as for special projects.

Staff will continue to evaluate ways of securing adequate revenue sources to support water resource management. DRBC staff will work to secure funding for ongoing agency support as well as for special projects. Staff efforts will focus on the following:

- Project Fees: Update fee structures for the regulatory program
- Re-establish and/or Maintain Signatory Party Contributions

### 4.4 ASSOCIATIONS AND INTERNAL ADVISORY COMMITTEES

This category includes both voluntary partnerships with national and international organizations and committees assembled by DRBC for expert advice and support for the development and implementation of DRBC programs.

#### 4.4.1 Associations

DRBC remains a partner in the Association of Clean Water Administrators (ACWA), the Interstate Council of Water Policy (ICWP) and the American Water Resources Association (AWRA). As water resource management faces the growing challenges associated with a changing climate, a challenging fiscal future, infrastructure needs, and shifting political environments, involvement with these partners will be of increasing benefit to DRBC.

#### 4.4.2 DRBC Internal Advisory Committees

Continuing a long standing practice, advisory committees aid the Commission in policy and standards development. Committees for flow, flood, toxics, monitoring, water quality, and water management meet on a regular basis. All administrative needs are met by DRBC staff, including the development of agendas, arrangement of venues, communicating with members, and processing formal meeting minutes. Staff also coordinates internally on issues that cut across the interests or expertise of more than one committee. Major focus issues for the Advisory Committees and subcommittees include:

- **Water Quality Advisory Committee.** The WQAC will be focusing on a review of nutrient issues in the estuary, the review of designated use and associated criteria for Zones 3-5, and the implementation of recommended revisions to ammonia and temperature criteria. Also, work is underway to: a.) develop a eutrophication model to test alternative water quality management scenarios and b.) facilitate outreach regarding management options. Work of an expert panel to consult on dissolved oxygen needs of estuarine aquatic communities will continue.

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- **Regulated Flows Advisory Committee.** The RFAC serves as a vehicle for public input into the Flexible Flow Management Program and will continue to focus on reservoir operations, instream flow needs, and other issues to support the Decree Parties in their work on the Flexible Flow Management Program.
- **Flood Advisory Committee.** The FAC will be focusing on outreach, coordination and collaboration for flood warning and mitigation, riverine and coastal flood mapping, and provide a forum for the continued interaction among local, state, and federal agencies and basin stakeholders.
- **Monitoring Advisory and Coordination Committee.** The MACC will review and offer recommendations for the improvement of basin monitoring activities and will seek to enhance coordination among the parties with respect to monitoring programs and data sharing.
- **Toxics Advisory Committee.** The TAC will be focusing on the review of new and existing toxics criteria including ammonia and emerging contaminants.
- **Water Management Advisory Committee.** The WMAC will be focusing on the results of the water loss accounting program, evaluation of consumptive use policy, instream flows, groundwater management and supply sufficiency.

### 4.5 UTILIZING PLANNING AND REGULATORY AUTHORITY

The Commission's planning and regulatory authority is used to facilitate, coordinate, and effect cooperation among water resource efforts across the Basin. Staff efforts to improve and direct the efficiency of DRBC programs include preparation of tools to guide resource allocation in accordance with Commissioner priorities. Based upon the mandate of the Compact and the goals of the Basin Plan, the Water Resources Program notes the current conditions and needs of the basin, the scope of DRBC programs, and the expected milestones to be achieved for a three fiscal year time horizon. The Annual Work Plan (AWP) for each year provides the planned activities and allotment of resources necessary for the upcoming fiscal year. The DRBC Budget details the receipt and distribution of financial resources in order to carry out the associated AWP.

- **Water Resources Program.** A prospective, multi-year program prepared annually.
- **Annual Work Plan.** Prepared annually.
- **DRBC Budget.** Prepared annually.

## DRBC WATER RESOURCES PROGRAM

### 4.0 INSTITUTIONAL COORDINATION AND COOPERATION

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Federal and Interagency Collaborative Partnerships			
USACE 4 <sup>th</sup> Federal Summit	Consensus on water resource priorities and collaborative agenda	As Needed	General Fund
USGS WaterSMART	Improved data and demand analysis; long-range water supply sufficiency analysis	2017	General Fund
Delaware Estuary Program	Participate in multiple committees (Steering, EIC, STAC) and in preparation of revised CCMP	Ongoing	General Fund
Upper Delaware Council	Ex-Officio Member; 4 meetings per year	Ongoing	General Fund
Fish and Wildlife Management Cooperative	Coordination, management plans	Ongoing	General Fund
Delaware River Source Water Collaborative	Participation in planning and education activities	Ongoing	General Fund

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State – DRBC Coordination			
Revise/Update DRBC-State Administrative Agreements	New DRBC-State Administrative Agreements	2017-2019	General Fund
Delaware Water Supply Coordinating Council	Meetings as scheduled, typically quarterly	Ongoing	General Fund
Pennsylvania Drought Task Force	Meetings scheduled as needed	On-going	General Fund
NJ Clean Water Council, permanent legislated member	Monthly meetings, periodic chairmanship, annual public hearing	Ongoing	General Fund
NJ Water Supply Advisory Council	Meetings as scheduled, typically monthly	Ongoing	General Fund
NJ Water Monitoring Coordinating Council	Meetings as scheduled	Ongoing	General Fund
NJ Water Resources Research Institute	Set research priorities; annual evaluation of research proposals for funding	Ongoing	General Fund
Data Sharing and Management	IT systems update and maintenance, GIS data assembly, processing and distribution	Ongoing	General Fund
Securing Funding	Meetings with federal and state legislators, state agency managers, and others re DRBC mission and value	Ongoing	General Fund
Associations			
ACWA	Contribute to discourse on national water policy, federal legislation and support for gaging infrastructure, and the development of federal decision support tools for water resource decisions	Ongoing	General Fund
AWRA			
ICWP			
DRBC Advisory Committees			
DRBC Advisory Committees	Meetings as scheduled and/or necessary	Ongoing	General Fund
DRBC Strategic Documents			
Water Resources Program	Prepared annually	Ongoing	General Fund
Annual Work Plan	Prepared annually	Ongoing	General Fund
DRBC Budget	Prepared annually	Ongoing	General Fund

## DRBC Water Resources Program FY 2017 - 2019

### Section 5.0 EDUCATION AND OUTREACH FOR STEWARDSHIP

- 5.1 Reporting
- 5.2 Public Information
- 5.3 Technical Outreach
- 5.4 Promoting Stewardship

#### 5.1 REPORTING

Many DRBC projects and programs have individual reporting elements. These are included as products and outputs for the fiscal year of their scheduled delivery. There are also routine reporting activities that require more significant resources for coordination, integration, and production. Among these are:

- **State of the Basin Report.** By resolution, DRBC is to compile an indicators report every five years to review current trends and conditions in the Delaware River Basin. The next report is scheduled for FY2018.
- **DRBC Annual Report.** Required by the Compact, this report reviews programs, activities, products, and milestones achieved during a calendar year.

#### 5.2 PUBLIC INFORMATION

DRBC staff responds in a timely manner to inquiries and requests from the general public, federal/state/local government officials, regulated community, students, educators, and the news media. This includes hosting visits by international delegations who wish to learn from Commission staff about water resource management at the river basin scale. DRBC also produces various publications and materials about the basin and water resource management issues.

The DRBC's web site continues to be the primary communications tool with its emphasis on providing information that is accurate, up-to-date, and presented in a user-friendly manner. The DRBC web site makes extensive use of links to external government and other sites where additional information is available. Listserv capabilities allow DRBC to provide subject-specific information via email to recipients who have subscribed on the web site to receive updates. The DRBC uses several social media tools (Twitter, YouTube, and Flickr) to share news on Commission activities and related information. In addition, the web site is used for on-line project applications, reporting, and payment.

#### 5.3 TECHNICAL OUTREACH

In order to keep current on technical issues and to share information with peers and various stakeholders, DRBC staff members attend and/or participate in regional, state, and national conferences and workshops throughout the year hosted by other government agencies, professional groups, or other organizations. DRBC periodically hosts workshops on timely issues. The DRBC web site is used to supplement this information exchange.

#### 5.4 PROMOTING STEWARDSHIP

Commission staff communicates information in various formats and, as funding allows, participates in a variety of events, workshops, and conferences throughout the basin to raise public awareness about water resource issues affecting the watershed and the need for stewardship. DRBC continues to support the Delaware River Sojourn through its active membership on the steering committee.

## DRBC Water Resources Program FY 2017 - 2019

### DRBC WATER RESOURCES PROGRAM 5.0 EDUCATION AND OUTREACH FOR STEWARDSHIP

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Reporting			
DRBC Annual Report	Report – post on web; limited paper copies	Ongoing	General Fund
Public Information			
Provide Timely Information to the Public	Clear, consistent message on water resource issues and DRBC activities; produce various handouts	Ongoing	General Fund
Media/External Relations	Clear, consistent message on water resource issues and DRBC activities; timely responses	Ongoing	General Fund
Web Site	New features, improvements, updated information	Ongoing	General Fund
Host Foreign Delegation Visits	Information exchange	Ongoing	General Fund
Technical Outreach			
Conference Attendance and Presentations	Information exchange	Ongoing	General Fund
Social Media	Information exchange	Ongoing	General Fund
Stewardship Events			
Community Events	Delaware River Sojourn, Lambertville Shad Festival, EarthFest, HydroMania, Coast Days, educator training, etc.	Ongoing	General Fund
Event Follow-up	Information on web site	Ongoing	General Fund

## DRBC Water Resources Program FY 2017 - 2019

**SUPPLEMENTAL TABLE A: SUMMARY OF PROSPECTIVE CHANGES TO DRBC PROGRAMS AND REGULATIONS**

Management Topic	Program/Project	Products/Outputs	FY 2017	FY 2018	FY 2019
Natural Gas and Related Infrastructure	Planning and Project Review	Natural Gas and related infrastructure regulations and guidance	Evaluation, Rulemaking and Guidance Development as directed		
Water Supply	Planning and Update to CP	Update Comprehensive Plan	Water Inventory, Water Budget and Needs Assessments	Water Supply Options	Initiate Comprehensive Plan Update
		Update Existing Facilities Inventory			
Flow Management	Ecological Flow Requirements	Update Water Code to include pass-by flows, conservation releases, and consumptive use mitigation trigger policies	Technical Review and Analysis	Policy Options and Recommendations	Rule-development and proposal, as appropriate
Water Quality	WQ Criteria	Revised PCB Criteria (TAC Support)	Stage II Report; EPA to Establish TMDL		
		Temperature (Zones 1A-E) and Basinwide effluent temperature standards (WQAC Support)	Compare to state criteria; Temp. Criteria Revisions	Rulemaking development	
		DO (Zones 2-5) (WQAC Support)	Updating Designated Use Recommendations; Model Development	Designated Use and DO Criteria Recommendations; Model Calibration and Evaluation	
		Nutrients (Zones 2-6) (WQAC Support)	Expert Panel	Recommendations for nutrient end points	
		Revised ammonia criteria (TAC Support)	TAC Recommendations	Rulemaking Process and Adoption	
		Revised bacteria criteria (WQAC Support)	Review recommendations for nationwide standards by EPA, and coordinate with states.	Rulemaking Process; recommended criteria revision	



## DRBC Water Resources Program FY 2017 - 2019

Management Topic	Program/Project	Products/Outputs	FY 2017	FY 2018	FY 2019
	Toxics	Develop criteria for toxic pollutants for Zone 1 (TAC Support)	TAC Recommendations	Rulemaking Process; recommended criteria revision	
	SPW (in cooperation with National Park Service and watershed programs)	Define existing water quality (EWQ) antidegradation targets for specific Interstate Control Points/Boundary Control Points in Middle and Upper Delaware (Zones 1A-D) (WQAC Support)	Targets and measurable change assessment finalized;	Policy Options and Recommendations	Rulemaking Process, as appropriate. Initiate 3-year monitoring/assessment program
Interagency Project Review Coordination	Project Review Permit Streamlining	Alignment with partner agencies to One Permit Program, where appropriate.	Administrative Agreements (AA) for PA and DE.		
	Regulations and Rules of Practice and Procedure	Update Articles 3 and 4 of Water Code and RPP for clarity and consistency with AAs.	Updating of Water Quality Regulations, Water Code, and RPP.		
	Project Review Fees	Update project review fee schedule	Rule adoption	Rule Implementation	

\* Note: order of prospective changes follows the format in the Water Resources Program

**DRBC WATER RESOURCES PROGRAM FY 2017-2019**

**SUPPLEMENTAL TABLE B: SUMMARY OF MODELING PROJECTS**

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Flow Management – FFMP Support	Use of and incorporation of various upgrades into DRB-PST model to support the evaluation of water supply management options, salinity intrusion, and support Decree Party negotiations	On-going	General Fund
Water Supply Planning	Identify water availability tool and assess against Drought of Record	On-going	General Fund
	Use of USGS-WATER with PST for macro-scale sustainability analyses	On-going	General Fund, WSSF
Emergency Response	Real time one-dimensional flow and transport model	Daily	General Fund
	Water quality model	As needed	
Lower Delaware River and Tributaries Model	Model refinement and validation	2017-2019	EPA §106, General Fund
Brodhead Model	Model refinement and validation	2017-2019	General Fund
Neversink Model	Model refinement and validation	2017-2019	General Fund, EPA §106
Lehigh River Model	Model refinement and validation	2017-2019	General Fund
Eutrophication Model for Delaware Estuary	Development of screening level 1-D eutrophication model	2017	EPA §106
	Selection and development of a state of the art 3-D hydrodynamic and eutrophication model. Data collection for model calibration	2017	EPA §106
	Model calibration and validation for CBOD, NBOD and ammonia allocations, and other nutrient requirements	2017-2019	EPA §106
CORMIX mixing zone models	Project Review and NPDES permit support	As needed	Project Review Fees